THE CHILD AND NATURE

OR

Geography Teaching with Sand Modelling

BY

ALEX. E. FRYE

FORMERLY PRINCIPAL OF THE QUINCY SCHOOL, QUINCY, MASS., AND
TRAINING TEACHER IN THE COOK COUNTY (ILL.)
NORMAL SCHOOL

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"The errors of the past are the wisdom of the present."

PREFACE.

GEOGRAPHY spans a lifetime; but as a common-school study, it consists of a natural sequence of subjects beginning in the primary grades and unfolding along the entire course. Every branch in the advanced work springs from a root in the elementary, and it is this unity of growth which alone merits the name of science.

The series of relations which link man to the mother earth can be properly traced only by considering the land masses, not as mere areas, but as solid forms, possessing not only length and breadth, but also the very important dimension of *height*. By this term is meant, not the mere location of plateaus and mountain ranges, but the varying elevation of the whole land surface above the sea-level, resulting in continental slopes. Is it not the threefold extension, or rather the relation of elevation to area, which conditions the distribution of life? and is it not the dimension of height alone, which divides the surface into the great slopes that form the river-basins, determine rainfall and drainage, distribute soil as food for plants, and thus prepare the earth to become the home of man? Any system of

geography, therefore, which omits the study of the great slopes of the earth, lacks a very essential element.

The aim of this work is, —

1. To grade and apportion the subject-matter of natural geography to the successive stages of development of the child's mind, and rid the study of its myriads of worthless details.

2. To direct attention to the laws of mind-growth which condition methods of teaching, and to suggest devices for stimulating and directing mental energy.

3. To review the literature of geography, and indicate lines of study for teachers.

It is sincerely hoped that what is here given will prove suggestive of something far better, and that the seal of individuality will be stamped on every teacher's own work. Let no man's ideal be slavishly followed, lest it become an idol; but use only what seems best fitted to stimulate a growing ideal.

In preparing this subject, much important geographical information was obtained from the excellent works of Ritter, Guyot, Humboldt, Wallace, Johnston, Huxley, Maury, and others; and grateful acknowledgment is now made them.

This book is sent out with the hope that it may lighten the work of teachers, and make the school-days of childhood happier and more profitable.

ALEX. E. FRYE.

CAMBRIDGE, MASS., Jan. 1, 1888.

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"Nature, the old nurse, took
The child upon her knee,
Saying: 'Here is a story-book
Thy Father has written for thee.'

"'Come, wander with me,' she said,
'Into regions yet untrod;
And read what is still unread
In the manuscripts of God.'

"And he wandered away and away
With Nature, the dear old nurse,
Who sang to him night and day
The rhymes of the universe.

"And whenever the way seemed long,
Or his heart began to fail,
She would sing a more wonderful song,
Or tell a more marvellous tale."

Longfellow to Agassiz.

THE CHILD AND NATURE.

INTRODUCTION.

CHAPTER I.

SHORT HISTORY OF GEOGRAPHY.

THE "nest places" of civilization were the fertile valleys and peninsulas about the shores of the Mediterranean Sea and Persian Gulf. In early times the natural surroundings of mountains and deserts shut out invasion of hostile tribes, while the many arms of the sea fostered commercial intercourse. Nature produced abundantly the necessaries of life, and at a very early period these great garden spots became the homes of the classic nations. Here we must look for the first records of geography. Here the sailor, the traveller, the soldier, brought together their accounts of foreign lands, people, winds, ocean currents, and apparent motions of the heavenly bodies; and gradually from these centres of learning the clouds of ignorance were rolled back.

The early history of every science must be an account of the gathering of the facts from which its laws are deduced. The mass of knowledge thus accumulated does not constitute the science. Not until some master-mind comprehends the unity in all, correlates the parts, and reveals the laws, is

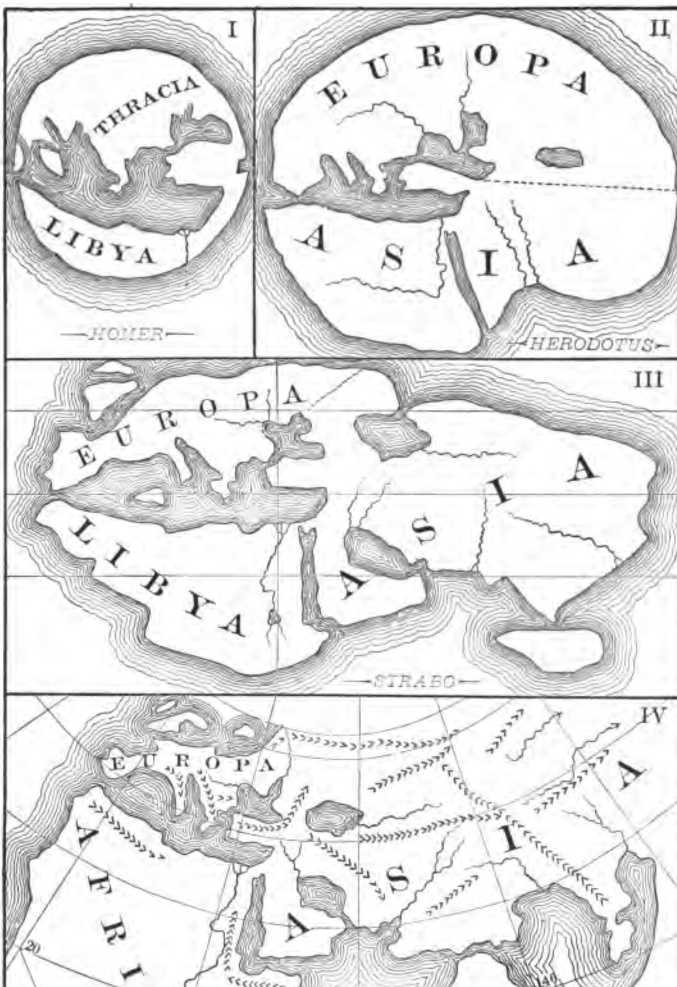
the science unfolded. The world has had many recorders, but few geographers. The early attempts to advance the study to a science met with but partial success, owing to insufficient data. Not until the great Humboldt had given to the world his "Cosmos," could the master-mind of Carl Ritter gather up the almost countless threads of past research, and weave them into the beautiful science of geography.

This sketch, with its series of maps, is intended to indicate in a general way the growth of geographical knowledge among civilized nations, and thus suggest a system of elementary study; for the *elements* of all sciences should lead along the lines of original investigation and discovery. Incidentally, the rise and decline of a few of the great empires may be noticed, together with the important historical events which have influenced exploration and discovery.

The first little map (p. 3) pictures the world as known to Homer about 900 B.C. Greece is represented in the middle of a great round plain, surrounded by the river Ocean. It is difficult to trace the history of discovery before this time, as the records are not authentic. It is believed, however, that during the "heroic age," the Argonauts explored the Black Sea, and that, a little later, the siege of Troy made known the countries of Asia Minor.

During several centuries before the time of Homer, the hardy Phœnician sailors had explored the islands and coasts of the great sea, planting colonies, and carrying on an extensive commerce. In the south, Egypt had already passed the most splendid period of her history (1500–1200 B.C.); but Ethiopia was still one of the most powerful states of the known world.

The Greek minstrel was acquainted with the countries bordering the eastern half of the Mediterranean, including Asia


I
THRACIA
LIBYA
—HOMER—
II
EUROPA
ASIA
—HERODOTUS—
III
EUROPA
LIBYA
ASIA
—STRABO—
IV
EUROPA
ASIA
AFRICA
20
60
100
140
—PTOLEMY—

Minor, Phœnicia, and Egypt; but his knowledge does not appear to have extended to the great monarchies in the valley of the Tigris and Euphrates.

The map (II.) of Herodotus (450 B.C.) shows a marked increase in geographical knowledge. The intervening period witnessed the establishment of large and flourishing colonies all around the shores of the Mediterranean and Black Seas. The Phœnicians, pushing boldly westward, had discovered England and Ireland, and had even sent their hardy sailors by way of the Red Sea to the Indies. The caravan trade had opened the eastern countries as far as India. Carthage had extended her sway westward to the Atlantic, and Rome was rapidly gaining the ascendancy in Italy. The three great Persian invasions of Greece, ending disastrously in the shipwreck off Mount Athos and the defeats at Marathon, Salamis, and Platæa, marked the beginning of the decline of the Persian Empire. The "age of Pericles" had begun in Athens, and that city was at the height of her glory.

The "Father of History" had travelled through Asia Minor, Phœnicia, Lower Egypt, and Mesopotamia, which, with his own country, he has accurately described; but he knew very little of the discoveries to the westward, and has not even mentioned the name of Rome. The known world was divided into Europe and Asia, around which he placed the Atlantic Sea. The far-away people of the North were called "Hyperboreans" (dwellers beyond the north wind), and the distant lands of the East were termed "Unknown Deserts."

The period of the map (III.) of Strabo is about the beginning of the Christian era. Geographical discovery had long before sounded the knell of mythology; for the supposed

dwelling-places of the gods had been explored, and their myths exploded. The victorious army of Alexander, after conquering the lands bordering the eastern shore of the Mediterranean, and all Lower Egypt, had broken the power of the Persians, and lifted the veil from all India as far as the Ganges.

The latter part of the third century B.C. marks the date of the first glimmer of the dawning science. Eratosthenes (276–194 B.C.) of the school at Alexandria began to explore the heavens for the key to mathematical geography, and is accredited with having been the first to discover the process, employed at the present time, of determining the magnitude of the earth by the measurement of an arc of a great circle. Nor was that all; for, as Ritter has indicated in "Die Geschichte der Erdkunde," he also studied the relation of irregular coast-lines to continental areas, together with the effects of great natural features upon climate; and used parallels and meridians in his maps to locate important places. Ancient records tell us that about this time also the first globe was made by Crates, so that this period may be truly said to have foreshadowed the work of nearly twenty centuries later.

Before A.D. 1, Rome had extended her sway, in the Punic wars, over Spain and the smaller possessions of Carthage; subdued Algeria; annexed all the Macedonian Empire west of Persia to her dominions; and in Cæsar's campaigns had conquered Gaul and invaded Britain. During this period, geographical knowledge advanced southward almost to the sources of the Nile, eastward to China, and northward to the Baltic Sea.

Claudius Ptolemy of Alexandria (about A.D. 150) was the greatest geographer of ancient times. His maps con-

tained all the important places of the known world, located by parallels and meridians. He computed the different altitudes of the sun in the various cities at the time of the equinoxes and solstices, from the proportion of an upright pole (*gnomon*) to its shadow; and from these calculated the length of the longest day in each place, thus determining its distance from the equator. The meridians were, of course, the lines having mid-day at the same time.

His books of "Universal Geography," summing up the knowledge gained through travel, military expeditions, and the great survey of the Roman Empire, constitute the masterpiece of the age. His system of astronomy which fixed the earth in the centre of the universe, and revolved all the heavenly bodies around it from east to west, ruled the scientific world all through the Dark Ages, save when the ban of the church made it heresy to hold any belief at variance with that of a flat round earth whose centre was Jerusalem. Considering the period in which he lived, the labor performed by this great man stands almost without parallel in the annals of science.

The map on p. 3 (IV.) indicates a marked advance in geographical research. It also illustrates the odd belief that Asia and Africa joined in the south, inclosing the great sea of India. This probably arose from mistaking the large islands of the East Indies for a continuation of the mainland. The accuracy with which many of the mountains and rivers are drawn is evidence of a fair knowledge of relief as well as of location.

But little advancement was made in geography during the Dark Ages. It is claimed, however, that about the year 1000 A.D., the Greenland colonies sent out an expedition

under Leif, son of Eric the Red, who discovered Newfoundland, Nova Scotia, and Martha's Vineyard. At the dawn of the new era, the discoveries of Columbus, Vasco de Gama, and Magellan, completely overturned the Ptolemaic system, and forced the scientific world to adopt the theory of a solar system. It is asserted that Pythagoras of Samos taught the rotundity of the earth, and its position in the solar system; but little notice was taken of this doctrine until it was revived by Copernicus, and still later by Galileo. Waldsee-Müller, a German professor, was the first to publish a map of the New World, in which he gave it the name America, in honor of Americus Vespucius, whose journeys afforded the data for the map.

About 1556 a Flemish mathematician named Mercator constructed the first map of the whole world, upon the projection which bears his name. Such is the chart used by navigators to-day, and no invention before or since, except the mariner's compass, has given such impetus to ocean travel. The sailor can now mark the shortest routes by straight lines, whereas before he was obliged to use complicated curves. The principal use of a Mercator's map is to indicate directions. The comparative areas of the continents and oceans are much more accurately represented by another projection, known as the *spherical*, first used by Philippe de la Hire (1640–1718). This distorts the hemispheres a little near the edges, but is superior to Mercator's in preserving the proportions of the great natural divisions. Other plans have been devised; but these two, or slight modifications of them, are generally used in representing the whole or any large portion of the globe. The *conical* projection is employed in mapping small sections only.

The opening of the present century marks a new era in

the history of geography. The scientific researches of Humboldt, followed by the skilful unfolding of the study by Ritter, soon placed it on "an equal footing with the sister sciences." The journey of Humboldt (1801–1805), which won for him the title of "Scientific Discoverer of America," and his later travels through Central Asia, are too well known to need repetition here. He was the first to teach geographers to indicate climate belts by means of isotherms; to divide the world into natural regions, basing the divisions upon natural features, for showing the distribution of life; to group the plants in a few great geographical families, and refer them to climatic conditions. We are, moreover, indebted to him for the first accurate descriptions of the basin of the Orinoco, the plateau of the Andes, Mexico, and Cuba; all of which are based upon personal observation and investigation.

He was also the first to discover the value of studying plateau masses in their influence upon drainage; and his cross-section of Mexico, from Acapulco to Vera Cruz, was the first cross-section of a continent ever made. His journey to Central Asia was followed by the first accurate description of the plateau portion of that continent, and later by his estimate of the average elevation of the continents above the sea. To him belongs the honor of the discovery of the individuality of the earth, which is the foundation of comparative geography. In such a sketch as this we can only glance at the chief features of his life work for geography, although every department of science was stimulated by his discoveries. It may be truly said of him, that under his touch chaos became cosmos.

It is difficult to decide which merits the higher honor, the man whose researches and generalizations lay the foundation

of a science, or the master-mind which adds the superstructure. They are one, and the names of Humboldt and Ritter must ever be placed side by side on the titlepage of geography.

"The individuality of the earth" became the "watchword of the new science." From the mere location of a mountain range to the great movements of nations, all became a series of living relations. Ritter's intellect was a touchstone to nature, and geography became "The Science of the Earth in Relation to Nature and the History of Man." To him the earth was "the theatre of human actions;" and the great migrations of nations over its surface or across its stage were the direct outgrowth of their own inner natures, influenced by their natural surroundings. He thus became the founder of the true philosophy of history which places it "within the domain of nature," and refers its laws to geographical relations. The trends of the great mountain systems, the comparative areas of highlands and lowlands, the proportions of continental surfaces to coast lines, the disposition of land and water areas, were studied in their influence upon climate, the distribution of life, and the intellectual development of the races.

The lives and works of these two noble men should be familiar to every child. To their marvellous powers of observation and generalization, we are indebted for the study of natural science in the public schools. Every geography, every map, every history, bears the impress of their great geniuses. One day, at least, each year should bring to the children the stories of their early lives, travels, discoveries, and the influence of their work upon our own daily happiness in school. As if the destinies of these great men were bound up in each other, they passed away at almost the same time, — Humboldt in May, and Ritter in October, of the same

year, 1859, — bequeathing to the world the fruit of their labor which will ever associate their names in the memory of a grateful people.

Nor should we forget our own Arnold Guyot who has labored so faithfully to introduce this science in America. The most illustrious representative of Ritter's work, he has not only stimulated the better teaching of geography, but his personal research has given him high rank in the world of science. By his recent death, the teaching profession lost its ablest exponent of comparative geography.

Much remains to be done. The science is still in its infancy, and the steps by which the minds of children can rise to its generalizations have not yet been designed. The great lines of observation are as yet merely indicated. But societies are being organized to promote geographical research. Teachers are rapidly awakening to the necessity of basing their work upon a more rational method than the mere memorizing of isolated details, and the movement seems destined to sweep all over our land. Hasten the day when the minds of our little children, instead of being warped and narrowed by dependence upon the generalizations and beliefs of others, may rise into full and natural activity by original investigation and independence of thought. Then, like Ritter, may they "find truth not in a single phase of truth, but in the union of all truth."

CHAPTER II.

VALUE OF STUDYING CONTINENTAL SLOPES.

The life of the earth springs from its slopes.

Wherever we examine the land surface, we find that it consists of slopes. It may be the almost imperceptible rise in the prairies or marine plains leading to the high plateaus, or even the abrupt mountain sides; but travel where we may, we shall find the surface everywhere changing its level. Slope is the unit of relief, and in its multiple combinations limits every form that gives variety to landscapes. Its simplest limitations are the hill and valley, and all other land forms are but modifications of these common types.

The surface of the globe consists, in general, of two immense slopes, the upper edges of which meet along the great continental water-partings, extending in the form of a loop or horseshoe from Cape Horn to the Cape of Good Hope (see map on p. 13); and the lower edges of which mark the line of deepest channels in the sea.

Within this great globe water-parting, the slope is very gradual, its lower half only being covered with the waters of the Atlantic; but without, it descends very abruptly, thus allowing the Pacific to flow in nearly to the foot of the primary highlands. For this reason, the Atlantic has a much larger basin but correspondingly smaller bed.

These great slopes are so related to the wind-belts that

the trade-winds with their monsoons are forced to precipitate rains alternately upon the broad plains of the eastern and western hemispheres, within and a little beyond the tropics; while the return trades perform a similar work for the slopes in the temperate zones. The globe relief, therefore, determines the rainfall and general direction of drainage; but the plan for collecting the water into basins, and for giving the exact direction to rivers is found in the continent. This is accomplished by placing secondary highlands upon the long slopes.

Thus, Fig. 1 is a cross section of the globe relief, and Fig. 2, of the continent. Each secondary highland sends

Fig. 1.

Fig. 2.

back a slope toward the primary, and the line along which their lower edges meet becomes the bed of the river which then follows the general slope to the sea.

To illustrate, let us examine the surfaces of the continents:

In South America, for example, we find on the west the plateau of the Andes, — a portion of the globe water-parting. From this, the long slope stretches to the Atlantic, the short one to the Pacific. Its position within the tropics opens its great plain to the moist trade-winds as far south as the mouth of La Plata. Hence the heavy rainfall east of the Andes, and the long strip of rainless coast on the west. South of 30° S., the return trades bring copious rains to Chili, but leave Patagonia on the east a sandy plateau. The fertile strip of Pacific coast near the equator results from the land and sea breezes in the belt of calms, and from a light

monsoon from Central America. The wet and dry seasons of the Orinoco result from the alternate north and south positions of the sun, whose heat turns the trade-winds here into monsoons.

Along the eastern coast, on the long slope, there is a secondary highland broken into two parts, Brazil and Guiana, which turn the water into three great basins, Orinoco, Amazon and La Plata, and thus determine the individuality of the continent. Every basin has three slopes; and here each pair of highlands furnishes the two whose place of meeting locates the river-bed, while the great plateau causes all to flow eastward to the Atlantic.

Any change in the position of the primary highland would produce a corresponding change in rainfall and drainage.

Transfer the Andes to the eastern coast, and the great forest of the Amazon would give place to a second Sahara. Stretch the western plateau of North America east and west across the southern part of the United States, and it would shut out the moist Gulf-winds that now sweep up the Mississippi valley. Place the Alps north and south along the west coast of Europe, and they would not only intercept the moist southwest winds flowing in from the Gulf Stream, but such an arrangement would also remove the great rain-condenser of the southern slopes, and let in upon those historic peninsulas the cold north wind. Alter the position of the plateau of Abyssinia, and the Nile and Congo would disappear. It is thus seen that primary highlands, to be of greatest value to a continent, must be placed along its lee side, so as to admit the moist winds to its great plains. A large part of the moisture is then precipitated by lightning, cold currents of air, and other causes, upon the lower as well as the upper portions of the slopes.

Likewise any change in the location of secondary highlands may turn the waters of a continent, with their load of rich silt, toward the equator or toward the poles; to produce like the Mississippi, or lie waste like the Mackenzie. Remove the low height of land across Central Russia, and that country would lose its great natural highway of commerce down the Volga to the Orient. A slight elevation would turn the Nile into the Congo basin, and give back to the desert the little strip of fertile land which the river has worked so many centuries to redeem, and which has exerted such influence in history. Join the table-lands of Brazil and Guiana, and the drainage of all Central South America would be modified.

Thus, while the general rainfall results from the simple

plan of placing the great plateaus across the wind circuits, the wonderful variety in continental drainage is determined by the relative positions of primary and secondary slopes. The lesser highlands tend also to equalize the distribution of rain upon the different parts of the long slopes, and prevent ocean-currents from washing away alluvial plains in process of formation.

The position of the plateaus, by locating rainfall and giving direction to drainage, also regulates the distribution of soil. Water is the great leveller. Falling upon the mountain sides and the slopes farther down, it immediately begins its work of disintegrating the rocks, and grinding still finer the pebbles and sand, while it tends to sweep all before it into the valleys. As the water deposits this rock material in the order of weight, beginning with the heaviest, we may readily understand why the finest and richest deposits have been made in the lower courses of rivers, and how the soil has been carefully graded throughout the river-basins of the globe. Thus we find that *slope*, as determined by the placing of the highlands, is nature's means of supplying the food which water prepares and distributes for vegetation.

The distribution of life over the globe is, of course, greatly influenced by temperature, as well as by soil and moisture. But while the spherical form of the earth tends to establish great belts of temperature, varying only with their distances from the equator, the relative positions and elevations of the natural features determine the many modifications that characterize portions of the surface in the same latitude. Chief among these modifiers is the arrangement of the great slopes.

The gradual elevation from the Arctic coast to the plateau of Thibet gives to Central and Northern Asia a temperature

far below that of the corresponding latitudes in the other continents; and the same highland, with its desert belt, influences the flow of the warm monsoons to India. The Alps which in former years were a greater barrier than distance would have been between the tropical and temperate belts, have ncw, by means of the mountain-tunnels and passes, placed side by side the sunny fruit-lands of the South, and the colder grain-fields of Middle Europe. These mountains, aided by the Gulf Stream and the Sahara, also give to Italy a tropical climate in the same latitude that witnesses in Chili great glaciers winding toward the sea. Mexico and the northern Andes serve to illustrate how a perpetual springtime may exist within the great tropical heat-belt.

Slopes then influence the distribution of vegetation, and through it the animal life, in various ways; e.g., by precipitating moisture, supplying soil and modifying temperature. To slope, in connection with the zones of heat resulting from the form of the earth, is mainly due the arrangement of plant life in great natural regions. In travelling northward from the equator, we pass successively through belts of tropical forests with their valuable woods and fruits; cotton, rice and canes; cereals and temperate fruit; pine forests; and finally into the frozen regions about the pole.

But on every side we see the influence of relief. By climbing a high plateau and mountain-range within the tropics, we may witness the same order of production as in our longer journey to the north. Again, in the same latitude, deserts and grazing-tracts often alternate with rich agricultural lands; and the reason for these modifications may be generally traced to the relative positions and elevations of the highlands.

The animals are quite as dependent as the plants upon the

continental slopes. Any feature affecting the distribution of food must prove an aid or a barrier to their dispersal. The oceans are, of course, the greatest limitations, and in one instance, Australia, have effectually cut off great families from the rest of the earth. Next in effect are the great plateaus and deserts. In the western hemisphere, the highlands of Mexico separate the families of the North and South. In the eastern, the cold table-land of Thibet and the desert plateaus of Sahara and Arabia set apart the fauna common to Northern and Western Asia, all Europe and Northern Africa, from that of India and also of tropical Africa. The great Sahara sea (of sand) is a much more formidable barrier than the Mediterranean.

In the natural regions thus marked out, the range of smaller groups of animals is also limited by lesser elevations. On our own continent, for example, according to Wallace, the western plateau has a group distinct from that in the western valley reaching from California to British Columbia; and also from that in the broad valley of the Mississippi. The height of land which parts the north and south drainage separates also the fauna of British America from that of the United States. The same influence of physical conditions is likewise observable in the other continents. We are thus led to the conclusion that a knowledge of the great slopes of the earth is essential to the intelligent study of the distribution of life.

Commercial intercourse is largely based upon the differences in production of the various parts of the earth, and its overland routes of trade are generally located by physical features. For how many centuries have the caravan routes from the Mediterranean countries to India converged upon the famous passes of the Suliman Mountains? The lower

cataract of the Nile, being the head of river navigation, has for a long period been a centre of caravan-trade with Central Africa. The remarkable valley of the Hudson and Mohawk through the Appalachian highlands led to the construction of the Erie Canal, and became the highway between East and West. Later, the railroad took advantage of the same natural feature. Then other passes were found over the mountains farther south, and new routes were followed. In the beautiful Keystone State there is scarcely a stream whose work of ages in carving those wonderful water and wind gaps has not already influenced the location of one or more lines of railroad. Even the vast western highlands opened that the two oceans might be joined by great trunk lines. The directions of nature's greatest inland highways, the rivers and lakes, are the sheer result of relief.

The termini and junctions of all these routes became the depots for the produce of the surrounding districts, and thus the great commercial cities of the world were developed. The grain and cattle products naturally centre in Chicago, St. Louis and Kansas City, for the lake, river and railroad traffic which terminates or passes through New York, Boston, Philadelphia, Baltimore and New Orleans. The cities about the Mediterranean Sea that formerly flourished in their extensive East-India trade date their decline with the voyage of Vasco de Gama which opened a new route and turned the trade to England, — the centre of distribution for Europe. Now we find London and Liverpool at one end; Calcutta, Bombay and Melbourne at the other.

But not only is man, as well as the lower animals, restricted to the food-producing regions of the earth: his occupations are also directly determined by the possibilities of natural production. Nature has allotted to each region certain voca-

tions, and set their bounds in the structure of the earth. The fertile valleys have developed the farmer; the poorer grass-lands, the shepherd; the forests, the hunter and trapper; the mountains, the miner, etc.

The influence of different occupations is an essential element in the study of the growth of civilization. Man owes his culture largely to work as determined by his physical surroundings. Geographers have long since shown that not in the frozen regions where his whole energy is bent upon securing even scanty food and shelter, nor yet in the torrid belt where all necessary products come as the gift of a lavish nature, do we find the highest type of man. The nations of culture and history have inhabited the middle climate where moderate labor and forethought have been rewarded by abundant harvests, and where nature has gradually yielded only before the unfolding intelligence of man.

Even here each kind of labor has greatly influenced the progress of its followers. The shepherd, wandering hither and thither in search of good pasturage, could have no fixed habitation. His social ties were few. He could not dwell in close communities. Schools and churches were unknown. He knew no law but his own will. His occupation awakened but little inventive genius. Having little, if any, communication with civilized nations, his progress was slow. Alone he could not master the great problems of cause in nature; and the mysterious, implying volition, became objects of worship.

Not so, however, with the tiller of the soil. He built a permanent home. Others settled about him, till the community grew to a village and perhaps a city. His labor tended to develop steady habits. Agricultural implements lightened his work, and invention was thus encouraged. He learned to

respect the rights of others; social ties were formed, schools and churches established, and laws became a necessity. He exchanged his produce with other nations, and learned their customs and laws. The early impulse to worship the mysterious was gradually developed into investigation of causation. Volition gave place to law, and his idols gradually dissolved before a developing intelligence, and the discovery of natural cause and effect. Knowledge purified his belief; and while the wandering tribes continued in their early instincts, customs and forms of worship, he rose rapidly to higher and higher planes of civilization.

Thus mankind may be divided into great classes whose culture varies largely with the demands made by physical surroundings upon their energies.

. . . .

When we turn from geography to history, we find that the relief of the globe still remains a very important factor. A glance at a physical map of the eastern hemisphere must convince any thoughtful person that (as Ritter and Guyot have already shown) the great migrations which have taken place from Central Asia into Europe were predestined by the relief to follow two lines of progression and settlement: the one to spread over the great grazing plains north of the mountain-axis stretching from the Pamir Plateau to Spain, the other to occupy the fertile valleys and slopes south of it; the former to become a succession of incursions of barbarous shepherd tribes, the latter the steady invasion of a rapidly developing civilization.

History has long recognized the stimulating influences which these advancing columns exercised over each other, wherever the structure opened and permitted them to flow together. Many times were the enervated nations of the

South inspired with new life by the hardy Northmen, just as China has received its strongest progressive impulses from the incursions of the fierce Tartar tribes, and more recent contact with western nations. The passes through the plateau wall by the Caspian Sea, across the plains of the Danube and in France were the scenes of the great race conflicts; and the struggle ceased only when North and South were blended into a brotherhood of nations.

If we would know why Babylonia, Egypt, Palestine, Greece and Italy became the seats of the most powerful empires of antiquity, we must seek our answer in the physical surroundings of those historic sites. Ancient Babylonia may be compared to a vast oasis, so completely is it hemmed in by desert plateaus. On the east and north, lie the barren table-lands of Persia and the mountainous district of Kurdistan; on the west and south, the great Syrian and Arabian deserts. No other portion of all Western Asia was, at that time, so well adapted by nature to support a populous nation; and thus this beautiful valley of the Tigris and Euphrates, with its mild winters, well-irrigated soil and extraordinary productive capacity, witnessed within its borders the rise of at least three great empires before the time of its conquest by Alexander.

Another of nature's great garden spots was Egypt, "the gift of the Nile." The fertile strip which the river has set free from the desert, by its annual inundation resulting from the rainfall in the highlands of equatorial Africa, is shut in on both sides by deserts and mountains; while its rich delta lands are in like manner protected from Asiatic invasion. This narrow valley, only about five miles in width and five hundred in length, not only supported a dense population within its own confines, but by a simple process of irriga-

tion, became the granary of the civilized world. While Greece was yet in her infancy, and many centuries before Rome was founded, this wonderful country reached the culmination of a civilization which, in many respects, was never surpassed by a classic nation.

Turning next to Palestine, we find another narrow tract lying between the Mediterranean Sea on the west; the valley of the Jordan, Dead Sea, mountains of Gilead and Syrian desert, on the east; the desert of Paran on the south; and open to invasion only across the narrow plains in the north. The great fortress which nature had erected about the home of Christianity and the Jewish civilization defeated every attempt of the invader to gain footing on this territory. Not until Jewish history had reached its most splendid period in the reign of Solomon, and civil discord had rent asunder the once magnificent kingdom, could the invading Babylonians conquer Palestine, destroy the "Sacred City," and lead away its inhabitants into captivity.

In no other country has the relief exerted a more marked influence over its people than in ancient Greece. Asia and Africa afford examples of wide-spread civilizations conforming to the vastness of the structure of their great natural regions. But Greece is the type of variety. By the mutual influences of its parts, it was enabled to rise far above the obelisk civilizations of Egypt and China. The Pindus range, with its many spurs sending their small peninsular headlands far out into the sea, and even continuing in the form of islands to the coast of Asia Minor, gave to this beautiful land, made almost sacred by its history, an internal structure favoring the formation of many independent states with different customs, laws, dialects etc.; also a coast-line enabling it to take advantage of its location in the middle of

the then civilized world, to develop the commercial intercourse which brought to its shores not only the wealth of the more ancient kingdoms, but also the culture of all the preceding centuries.

Greece thus became the type of later European history, not alone in its entirety, but likewise in the development of such states as Spain, Austria and Germany. Moreover, its structure protected it from the invasion of Northern tribes and Asiatic hordes, except through the narrow passes by Mount Olympus and Thermopylæ which were easily defended. Not until civil dissension had severed the bonds of union between the little sister states, did this civilization, which had withstood the pressure of the whole Eastern world, fall an easy victim to internal decay. Then the hardy Gauls, pressing across the plains of the Danube and through the mountain passes, destroyed the city which both Neptune and Minerva claimed, but which became the rich inheritance of the whole world.

It is not necessary to multiply examples. The mere mention of Rome will suffice to recall the protection afforded Italy by the Alps. Not until the legions in their conquests had pointed out the highway of invasion to their barbarous foe, and not until the seeds of dissolution had been sown in horrible licentiousness and civil strife, could the hardy tribes of the North, retracing the footsteps of their oppressors, sack the "Eternal City."

Likewise the southern shore of the Mediterranean and the western coast of Arabia, each protected by its sea and desert plateau; India, cut off from the wandering tribes by its surrounding structure, yet containing within its bounds the variety essential to development; China whose empire in itself resembles an almost isolated continent; Mexico and

Peru in their plateau fortresses, — each has bequeathed to the world a share of the culture of to-day, bearing the impress of the many characteristic physical features of its centre of origin.

What an important part the Pyrenees and Balkan Mountains have performed in the religious and intellectual development of Europe! When the Mohammedan invasion through Spain threatened to flood all Christendom with the "religion of the sword," and the crescent went down before the cross at Tours, the Pyrenees became the natural boundary for at least three centuries between the Franks and Saracens. Nor were they finally separated by the Mediterranean till the year that marks the first voyage of Columbus to America. The culture of South-western Europe received powerful stimulus from the arts and sciences of these learned Moors, but the mountains saved Christendom from their religious oppression.

History is, in part, repeating these events around the Balkan range. Already has the Mohammedan invasion from the East been turned back from Austria by Sobieski; and although the mountain-fortress of the Balkans has been a natural boundary between the Turks and their Christian foe, the pressure of a higher civilization is steadily forcing the alien (?) religion from European soil; for even in our day the golden rule of state diplomacy is, "Might makes right," when territorial acquisition is the reward.

Turning from examples of national progress to the important battles that have perhaps decided the fates of nations, we cannot fail to agree that the structure of each of the great scenes of conflict has very often determined the result. Miltiades recognized this when he took possession of the little plateau overlooking the crescent-shaped valley of Marathon; and so also did Leonidas when he posted his men in the Pass

of Thermopylæ. The terrible ravines in which the Roman legions under Varus were annihilated; the hidden gully that opened under the Emperor's guards at Waterloo; Bunker Hill, Little Round Top and Cemetery Hill are other familiar illustrations.

The Helvetians in their mountain-home were invincible; but when they descended to the plains, they were quickly forced to yield before Cæsar's legions. The Welsh of to-day owe the preservation of their language and customs to the mountains of their country. The highlands of Scotland sheltered a free people for a long time after the lowlands had passed under the yoke. How much of English and Scottish history centres about the Cheviot Hills! The great natural highway between Canada and New York decided the plan of the campaign that ended in the surrender of Burgoyne; and the structure of the States lying east of the Mississippi River determined the three great lines of invasion of the South during the late Civil War.

How necessary, then, to the intelligent study of history is a knowledge of the general features of relief of the earth's surface which have greatly influenced the movements of nations. Not only are they the best possible aid to the memory of those events, but because of their influence they also become an essential element in the philosophy of history.

PART I.

HOME GEOGRAPHY.

CHAPTER III.

SAND MODELLING IN ELEMENTARY GEOGRAPHY.

THE study of relief has given rise to many devices for aiding the imagination to picture the surfaces of the continents. Maps made of papier-maché, layers of cardboard or leather, stamped paper, carved wood, putty, clay, plaster of Paris, and various glue and whiting mixtures have been used with success; but the device best known and most extensively used is *sand modelling.* The excellent results obtained from this natural language of form seem to insure its general adoption. Before discussing its practical value in the schoolroom, it may be well to consider the laws that condition the development of form perception.

Although psychologists and physiologists may differ widely as to the perception of extension or the first and second dimensions, by sight, binocular vision, touch, or the muscular sense, they agree that the original sense of solid form or the third dimension is touch or rather the muscular sense of grasp, just as that of color is sight, and of sound, hearing. Sensations of roughness, sharpness, roundness, surface

slope, relief and the like are occasioned by touch primarily. But from early childhood, in seeing and feeling objects at the same time, we have learned to associate the light and shade perceived upon an object with the sensation of touch, and thus acquired the faculty of judging of form by sight. For example, we feel carefully the surface of a ball, occasioning the sensation of roundness. At the same time, we perceive the gradual blending of light and shade upon the surface. The touch sensation is associated with that of sight, so that either may readily recall the other; and a similar light and shade perceived elsewhere may suggest the sensation of roundness.

In the same manner, a uniform shade may be associated with a flat surface; and a sudden change of shade, with a sharp edge. Thus we acquire the capacity to cognize solid form, or the third dimension, through the medium of sight; or, to state it more clearly, the natural light and shade upon an object enable us to judge its form. In fact, after sufficient experience, the eye almost displaces the hand as the organ of form perception, and the mind unconsciously interprets sight percepts as form percepts. In matters of doubt, however, as to solidity, we invariably confirm our judgment by the original sense of touch. The acquired sense may be deceived, but the original never errs. A painted disk may represent to the eye a ball or an orange, but to the hand it must reveal its flatness.

And yet the acquired sense is of far greater practical value than the primary. By it we can discern forms near by or at great distance, in rapid succession and multiple combinations, without going through the slow and laborious process of touch. But the accuracy and value of the sight in perceiving form depends upon the distinctness of the

sense products of sight and of the muscular sense, and the consequent clearness of the association of these products. This necessitates the education of touch and sight simultaneously. The hand and eye must work together in order that the sensations may become parts of the same mental state. Each of the parts thus associated will ever after tend to suggest the other. Moreover, knowledge of a form is more quickly acquired by perceiving it with two senses at the same time, for each is verifying and recalling the sensations of the other, thus making the knowledge more certain. At the same time, the sensation of light and shade is becoming ever more closely associated with its corresponding touch sensation, making the acquired sense of sight more accurate and useful.

A necessary condition in the acquirement of distinct sense products is repetition and intensity of perception. In the rapid play of any sense, e.g., sight, it rests but a moment upon a form, and then seeks another unless some *stimulus* holds it to a particular form. This may be natural curiosity or a supplied requirement. In order to rivet the attention closely upon a bird, we ask the pupils to describe it, thus supplying the incitement which necessitates many acts of perception of this particular object. An accurate description implies clearness or intensity of perception.

Again, we ask them to draw the bird, and by this means direct the mental activity to the relative lengths and directions of portions of its outline. But to require a class to model a bird in any material insures a closeness and repetition of perception attainable by no other device, inasmuch as it calls for the reproduction of the exact form and outline in detail, and brings both sight and touch into activity at the same time. The modelling or reproducing is in itself merely

expressing what is already in the mind; but by constantly stimulating sight and touch to perceive the perfect object, it corrects and adds to the concept.

This leads us to the first use of sand modelling in teaching the land and water forms. It is a means of stimulating the attention, or of securing close and repeated acts of perception of forms in nature, thus enabling pupils to obtain accurate knowledge of the elementary forms, in the shortest possible time. The little models in sand become a language or means by which the teacher may aid the pupils to bring most vividly into consciousness, with least effort, any forms to be compared, or upon which a force like running water is to be set to work. Later, it may be used as a means of aiding to imagine or read the surfaces of the continents. As the forms in sand are a natural language, perfectly symbolic, any child can model the geographical forms of which he has distinct mental pictures. Hence, to the teacher, modelling becomes an excellent means of examining the forms in the child's mind, whether they be simple hills and valleys, or the more complicated forms of continents. Here no lack of technical training in language hinders the full and free expression of thought, and no time is required to memorize symbols.

The moulding sand has been criticised as presenting lifeless and minute forms in place of the real forms of nature teeming with life. The criticism should not stand against the device, but against one manner of using it. In geography, as in other studies, we may find teachers who are teaching the language of the thing instead of the thing itself. Modelling is merely a language of natural forms, and any one who attempts to teach nature through its symbols commits a radical error. The sand should not be used as a

means of presenting but of representing the forms of land and water to pupils. *We should teach directly from nature* which is everywhere present, and *use the sand merely to stimulate perception of the reality* by requiring its reproduction by modelling. Then, like any other language, it may be used to recall the concepts of these forms in new relations when a foreign land is to be imagined. The child's ideas should come from the field, the forest, the river, and will then have the size, coloring and life of nature, unless the teacher tries to supplant the thing itself by a mere language.

Pictures and stories should also be used as a means of leading out to observe the real forms. But whether as a means of securing attention, or of aiding the imagination of distant forms, the language of sand has this great advantage: viz., its signs are types of the forms to be represented or imagined; and the attempt to reproduce is the best possible incitement to observation of the natural forms.

The teacher may fall into some errors in modelling, just as in using any other device. There comes a time when its further use must hinder rather than aid the development of the imagination. The time is clearly indicated by a state of the mind, so that the error may be easily avoided. As soon as the pupils can recall the natural forms distinctly without the assistance of the moulded forms, they should be required to use the imagination, and the sand should be laid aside. Just as in teaching number, we put away the objects as soon as they can think numbers without them; and as in teaching reading, the objects used at first to aid in making the association between the words and their appropriate ideas are dispensed with as soon as the names will recall the ideas with sufficient distinctness: so we give up the modelling as soon as pupils have clear concepts of

forms, and can imagine them in new relations without its aid. Ability to model all the forms accurately and quickly from memory may be made the test of distinct concepts, provided the children have learned the forms from nature.

After the forms are known, however, if a lesson is to be given in which form is secondary to some other subject of the work, the sand may again be used to advantage as a means of aiding the imagination, and of securing attention to the real object of the lesson. Thus we may wish to represent the wearing of water upon a slope. The pupils know the form, and can model it readily. Nevertheless, as our primary object is to teach the wearing of water, we make the slope in sand, and pour the water upon it as a means of inciting them to observe the effect of a force upon a form.

Again, if we are reading about the camel, we model a desert to aid the mind in associating the animal with its home. In teaching a battle, e.g., Bunker Hill, we model the hills and harbor to aid in picturing the relative position of the contending armies, and the natural advantages which the structure afforded the Americans. This is analogous to using the blocks or other objects to aid pupils to see relations or conditions in problems in arithmetic, even though the numbers themselves are known. Not numbers themselves, but the conditions of a business transaction, are to be thus vividly portrayed. That is, although in the study of forms the sand should be laid aside as soon as the imagination can picture distinctly without it, yet when the main object of the lesson is to observe the effect of a force or any thing related to a particular form, the sand should again be used as the means by which the forms may be most vividly recalled with the least mental effort, thus setting the mind free to concentrate its full power upon the study of relations.

Every Scylla has her Charybdis. While trying to avoid the over-use of sand, great care should be exercised never to require a child to reproduce a form that is not distinct in his mind, unless the real form is near by for comparison. No good can come from such reproduction, while evil results may attend it. The imperfections will be more firmly fixed in memory, and the child will be forced to a false and careless habit of expression. The same danger exists in teaching other subjects. We should not require him to speak or write a sentence until the thought stimulates it. In teaching spelling, if he is not sure that he can write a word correctly, set a copy or send him to the dictionary. The attempt to reproduce in any manner, without a copy, that which is vague in the mind, develops a habit of hesitancy, and as a natural out-growth, carelessness that no amount of training can completely eradicate. Herein is the economy of giving the early modelling exercises in the fields where nature supplies an endless variety of forms for study and comparison.

Another and perhaps the chief error consists in trying to use the sand in the place of nature. We should guard very carefully against this. Let the device merely incite interest in the reality. Pupils should not study the objects *in* the sand, but *through* it. Fill the mind with forms in nature of which the models are but signs, and thus prepare them to see the whole world in the school district.

One device should not take the place of others, but should only supplement them. Each has its value in arousing certain activities; and sketching, painting, reading, describing, pictures etc., all have work to perform.

The special application of sand modelling to the various subjects will be shown in the "Illustrative Lessons."

SUMMARY.

1. Modelling is a means of gaining concepts of form through touch or the muscular sense; and, by the association of these concepts with the corresponding sight products of light and shade, of cultivating the acquired judgment of form by sight.

2. It is the best device for securing attention or repeated acts of perception, and thus develops observation and memory of form.

3. It is the simplest and quickest means of leading pupils to acquire knowledge of geographical forms from nature.

4. It is the means of bringing forms most vividly into consciousness, and so conditions accurate comparison, reasoning, and judgment.

5. It lays the basis in a natural language for leading pupils to imagine the continents.

6. It is the most natural means of form examination, as ability to model quickly and accurately from memory may be accepted as evidence of clear concepts.

7. Lay aside the sand as soon as pupils can readily imagine without its aid.

8. The sand may again be used when the main object of the lesson is to study the relations of one form to others, or of a force to a form.

9. Until the form is distinct in the pupil's mind, he should never be required to model it, unless the real object or a correct type of it is near by for comparison.

10. In learning outlines, use drawing; in studying relief or surface slope, use modelling.

CHAPTER IV.

PRIMARY LESSONS.—FIRST TWO YEARS.

The study of geography begins as soon as the senses are awakened to nature. The delight that the little ones take in gathering pretty objects is the capital for the teacher's work. How interested they are in bright-colored flowers, insects, birds and pretty pebbles which cover the first few pages of the wonderful book of nature! How they enjoy its bright pictures and pretty stories! and when they enter school after a few years of freedom, the chief work of the teacher is to deepen and broaden this interest. Their tender minds are not yet ready to be harnessed to an inflexible course of study. They must be gently and gradually trained to habits of consecutive work.

Play is the natural device for developing little children, and should be encouraged till they grow away from it. Let them play with nature, and it remains their friend and teacher instead of becoming their taskmaster. If they cannot go out into the fields to study, let them bring in the pretty leaves, pebbles etc., and use these little gifts, when possible, in oral language, drawing, reading and number lessons.

SAND-TABLE.

Let the pupils have a large sand-table upon which to play. Modelling is the simplest means of expressing form, and naturally precedes drawing. The same delight that children

take in digging sand by the seashore, or in making "mud-pies," may be made a means of mental growth in the schoolroom, as it has already been in nature. In the dry or slightly moistened beach-sand, they will make hills, valleys, roads, houses, farms, rivers, ponds etc. With little strips of wood or splints, they will put in fences, bridges and trees. Tell or read to them simple descriptive stories, allowing them to make the pictures in the sand, and draw upon the blackboard or paper what they model. *Every attempt to express leads to closer observation.*

Try to appreciate the best effort of the child, however imperfect the result may be. His concepts of form are not distinct, neither is his skill to express developed; and herein lies the opportunity for growth. He is not conscious of his shortcomings. The picture or model approximates his ideal, and he is therefore not ashamed of his work, but is ready to try again and again. Now let skill to express keep pace with the concept growth, and he will delight to picture to others what he has in mind. Development of skill in any form of expression implies concentration upon an object of thought; i.e., *skill re-acts to awaken thought.*

To the child, the little forms in sand are pictures in nature just as the bundle of rags is a beautiful doll. The imagination readily supplies what is wanting in size and color, because the little model is only a sign of the concept gained from nature. The fact that this power of the mind is exercised is the real source of his delight, for a toy so perfect that nothing is left to the imagination is soon cast aside. It is not the real but the "play" horse that pleases. He will call the little pile of sand a hill, the little hollow a valley, and will think of them as such unless the teacher breaks into this beautiful imaginary world, and makes him conscious of its deficiencies.

Let the acts of association between the forms in nature and their signs in sand be, in so far as is possible, unconscious; i.e., let the child select, as he naturally will, the little representations or models. He will then associate the signs with his ideas, and thus prepare a natural language of his concepts which may be afterwards used by the teacher to aid him in imagining the relief and life of foreign lands.

CLAY MODELLING.

Potter's clay may also be used to advantage in training the child to perceive and reproduce form. Modelling apples, pears, peaches, cherries, cucumbers, in fact any fruit or vegetable; dishes, tables, leaves, crystals, animals, and lastly the geometric forms, — not only develops the senses of touch and sight, but also affords an excellent opportunity to lead the child into the "Fairy-land of Science."

During the first year, have the objects before the class for imitation. Occasionally during the second year place a simple form before them for a short time, then remove it and let them model from memory. Allow them to make from memory things they have seen at home or elsewhere. To teach comparison, let each make some object shaped nearly like a ball, cube or other regular form. As a rule, have the objects to be modelled near at hand, to avoid forcing the memory, and training to careless forms of expression.

Call for the names of objects similar in form to each other, thus leading them to classify. Give opportunity for the imaginative and inventive faculties to express freely, and so stimulate them to activity. Keep in mind that the object of the work is not the perfect ball or orange, but *accuracy in seeing* and *skill in expressing form.*

As all concepts of solid form come originally through the

touch, or rather the muscular sense of grasp, and as the accurate seeing of form depends upon the association of light and shade with sensations of touch, it is of the utmost importance that children use only the sense-organs in modelling. Patting and rolling the clay upon the desk, or cutting and smoothing it with a knife or stick result in about as much development of power to perceive form, as pouring lead into a bullet-mould, or making bricks in a press. Let us ever keep in mind that the clay form in the child's hand is merely a means of directing his observation to a perfect model set before him. Therefore do not consider that device the best which enables him to reproduce the model most quickly and accurately; but rather, that which stimulates his attention most often and most closely to the perfect form set before him. All forms which are to be imitated should be handled as well as seen; in fact, the former is, in the beginning, more important than the latter.

It is a very interesting experiment to blindfold pupils occasionally, and let them model by the sense of touch unaided by sight. Place a form, such as a fruit or vegetable, where the children can touch and handle it with eyes closed. Ask them to make it in clay, thus requiring them to perceive its form through the touch (or muscular sense of grasp aided by the sensitive finger-tips). This tends to intensify the percepts of form, and cultivates a very delicate sense of touch. The models made under these conditions are usually quite perfect. The practice of destroying the work of the children as soon as the lesson is finished tends to discourage careful work. If the clay must be immediately packed or wedged for use next day, the forms should not be destroyed in the presence of the class.

COLOR

Color is taught in geography as an aid to seeing and imagining forms as they appear in nature. Place upon a table a collection of bright-colored objects, such as flowers, feathers, fruits, worsteds, ribbons and splints. Let the pupils sort them by putting like colors together. This exercise trains them to distinguish readily. Matching should be made the test for color-blindness.

Place a color before the pupils, and ask them to name objects of the same color in the schoolroom, or to bring something like it the next day. This will develop observation and memory, and cultivate habits of classification. When pupils recognize a color readily, give its name. To aid the association of names with colors, ask pupils to select from the table, e.g., all the red objects; then, to name any others they can see. When the names recall, present various articles and require pupils to name the colors. Thus they learn to recognize, compare, classify, select upon hearing the names, and to use the names.

Use but few colors at first, and these as near the standard as possible. The most important part of the work is to lead pupils to observe them in clothing, animals, fruits, leaves, sunsets, rainbows etc. Even the youngest pupils may learn much from the box of ordinary water-colors, using them in painting leaves, birds and fruits. This device presents an excellent opportunity for teaching tints, shades and hues later on.

Obtain from a glazier bits of colored glass for pupils to look through. In some respects this is superior to paints in teaching combinations. Holding blue glass (or gelatine paper) towards the light, and placing with it red, violet is

produced. Likewise red and yellow give orange; blue and yellow, green. Placing the green and orange together results in citrine; green and violet, olive; orange and violet, russet. The glasses have the advantage that, after any color is produced, it may be analyzed by noting what glasses are combined. By using them in a small solar camera or magic-lantern, and projecting the colors upon a screen in a darkened room, intense interest may be awakened. Tints and shades may be very easily produced by placing few or many pieces of the same color together.

Although natural sensibility may enter somewhat into the discernment of the beautiful, taste is largely the result of culture. Indeed, it may be questioned whether what is termed natural sensibility is not in reality hereditary culture. We see only harmony of colors in nature, and therefore take it for our guide in matters of taste. Because combinations in nature have ever been the same, may not harmony be the result of ages of presentation of the same combinations to the sentient nerve of sight, thus developing that sense to receive with less and less resistance the waves of stimulation of so-called harmonious colors, just as repetition of stimulation of any sense renders that sense more susceptible to succeeding sensations of a similar kind? However that may be, the fact remains that taste in arrangement of colors may be developed by studying coloring in nature.

Let pupils name the combinations of colors on sweet-peas, pansies, pinks, autumn leaves, begonias, birds, butterflies etc., and make similar combinations with colored crayon, paints, worsteds and paper forms. Cultivate taste, not by trying to explain the law of harmony which requires the presence of certain complementary colors, but by leading pupils to observe combinations in nature. Taste is ability to

discriminate harmony, rather than mere memory of combinations that harmonize; and should be developed by allowing pupils to judge which are the most beautiful of many combinations made by nature, themselves and the teacher. The nature study should in all cases precede.

This work can, of course, only be begun during the first two years, but it should be continued through all the grades. No work is more practical; and yet it may all be incidental to language, number and reading lessons.

FIELD LESSONS.

Whenever it is possible, take short field trips with the pupils. Have number and language lessons where the little ones can gather numbers of beautiful things to talk about. The first work in language is to lead children to talk and write fluently by giving them something to stimulate thought; and when they have acquired an easy flow, to correct faults, or rather cultivate correct habits of seeing and expressing. In the fields there is food for thought, and the clatter of busy tongues — evidence of active minds — gives the teacher the opportunities for correcting errors that require so much hard work in the schoolroom. The corrections will be the more lasting from the fact that they are made while the mind is in this highly active state.

Not only may the forms of land and water be taught in this manner, but also directions and locations of objects; and the cardinal points of the compass may be determined by the sun.

PLANTS.

If the school is in the country, have little flower-beds in the yard. Let the pupils prepare the soil, plant the seeds, pull out weeds, water and take general care of them. City

schools can have a few boxes of loam and sand. But whether inside or outside the schoolroom, use only the seeds of plants which, either by their modes of growth or commercial value, will aid the pupils in their future studies. For example, plant corn, beans, melons, acorns, oranges, cotton and rice; also set out an onion and a potato. Encourage the children to make little wooden hoes, spades, ploughs and rakes, and use them in the gardens or boxes.

Give language lessons upon the leaves, stems, roots and flowers, as soon as they appear, and in this way arouse an interest in observing growing plants. The children may be led, very slowly of course, to discover the simple relations between soil, moisture and heat that regulate the distribution of vegetation. This kind of work will also cultivate the excellent habit of patiently studying an object through successive stages of growth.

ANIMALS.

Language and drawing lessons may be given about common animals that are types of orders or families; e.g., cat, worm, clam, starfish, duck, frog and perch. The object should be to develop an interest in animal study, and this can best be done by leading them to *discover* something. They should study the parts which are the basis of classifition; also name other animals having similar parts, thus cultivating observation and classification. The work should be very simple, and the only classification should result from the pupils' own discoveries.

MINERALS.

Teach them to recognize a few common minerals by using them in number and language lessons. Let them make a collection of the minerals of the district for a school cabinet.

SEASON TEACHING.

Another line of work may be begun by leading pupils to observe the wonderful phenomena of changing seasons, — snowflakes, hailstones, frost, dew, rain, varying colors of leaves and grass, ripening fruit etc., at times when nature best illustrates them. Draw the clouds and watch their motions. Watch for the first returning birds and the earliest opening buds. Note which birds remain with us all winter, and which fly away; in what direction they go, and when.

SUMMARY.

No extra time is needed for the work here outlined. It may be made supplementary to the other studies. These first steps may be woven into the number, language, drawing and reading lessons; and the increased interest which natural objects will arouse in those subjects will greatly lessen the work of the teacher. Moreover, upon what objects can more practical lessons be given than upon such as help to prepare the pupils for the work of the higher grades, and at the same time afford the best possible training for the senses?

"When it is more generally understood that the mind is primarily the product of sensation, — that without sensation there can be no mind, — more importance will be attached to giving direct attention to the cultivation of the senses. Touch and sight are of far more importance in intellectual training than hearing, yet the latter sense is the one usually relied on by teachers to produce impressions. When sight and touch are called into action, children observe and think, while by hearing they are led to listen and remember. Observation and thought bring knowledge, habits of self-reliance

and investigation; while mere listening and remembering foster belief, imitation and dependence." —*W. W. Speer.*

Let our aim be, first, to interest our pupils in natural objects and forms; second, to quicken the senses; third, to lay a foundation in knowledge for future study. The highest test of good teaching will be the increased love our little ones have for nature.

CHAPTER V.

A.—DISTRICT RELIEF.

First Steps. — The first work in elementary geography is to lead the pupils to acquire distinct mental pictures of the forms of land and water about home, and to study the forces of water, air etc., which act upon these forms to prepare the surface to support life. The imagination of form is limited to sense products. Our concepts of foreign lands and phenomena which we have never seen are made up purely of our sense products, grouped, perhaps, in new relations in imagination. We may never have seen the great desert in Africa, — its vast stretch of burning sands, its oases and terrible sand-storms, — and yet we have mental pictures of all these. Some field of sand, a meadow spring, and the whirling dust in the street, aided by pictures interpreted by means of our sense products, have formed for us the great Sahara.

Every school district is a world in miniature, for it repeats the structure and story of its life in pictures so vivid and language so simple that every child may see and read. All forms of land and water, the forces at work building and wearing, the conditions that regulate the distribution of plant and animal life may be discovered before every school door, repeated in endless variety. Often we must seek the greater through the lesser, but the imagination readily enlarges a

picture. Thus we study the hillside as a basis for imagining the great slopes of the earth's surface; also, the brook basin that we may imagine the drainage of the great river-basins. The little deltas formed in the street-gutters show how the great alluvial plains of the world have been formed; while about us on every side are plants and animals, types of the great families that cover the earth. "Every little nook and shaded corner is but a reflection of the whole of nature." This, then, is fundamental: The first step in geography is to study that part of our district which may be *seen* and *travelled over*.

What to Teach. — We should teach nothing for the sake of the thing itself, but as a preparation for what lies beyond. We present our district, not that the child may become familiar with the hills and valleys of his own town, but that through them he may be enabled to imagine the surface of the globe. Neither should we teach a form or a force merely because it affords an opportunity to develop mental power. While the highest aim of all teaching should be power or character, we should ever keep in mind that the greatest power is developed from right study and use of those things which are most practical, and which, by their repeated use, are continually arousing mental activity. In deciding what to use, we have a sure guide: *Teach those forms, forces and conditions only that should make up the child's world picture.*

Sand-Table. — Make a table-top (see frontispiece) about three by four feet, with a rim raised two inches. Place this on a small table or stand about thirty-two inches in height, and fasten at one end by hinges so that it may be inclined toward the pupils. Strips of wood, such as are used to hold up piano-tops, may be used to support it at any desired angle. A zinc-lined drawer placed under the table for

holding sand will be found convenient, although it may be kept in any common box or bucket. The table-top should be made of pine or whitewood, well seasoned or kiln-dried to prevent warping and cracking. A coat or two of blue paint to represent water on the table will also tend to preserve it.

Model Tins. — These tins may be obtained from any tinsmith, and should be made of a good quality tin, fourteen by twenty inches, hemmed, rimmed one-half inch, with the hem turned out, and corners soldered.

So far as is known, "model tins" were first used in 1881 by the pupils whose lessons are reported on p. 52 *et seq.* It is gratifying to note that many thousands are now in use in various sections of the country. This device supplements the sand-table, and insures individual attention and work by requiring all the pupils of a class to model at the same time.

Care of the Sand. — Fine sand of any kind may be used in modelling. An excellent quality may be obtained from any iron-foundry. Order the finest sifted moulding-sand. Fine beach-sand is also good. Keep it *moist* by *sprinkling* on it a little water each day after using. Do not attempt to stir or mix the sand while wet. Let it stand over night, and the water will filter evenly throughout, preparing it in the best possible way for use next day. If kept in a covered box, it will require but little water. The exact amount must be learned by experience, as the quantity will vary with the temperature and humidity of the atmosphere. It retains its form best when only moistened, and should never be wet enough to stick to the hands. Always put the sand in the box, and cover it as soon as possible after using.

Use of Devices. — Distinct mental pictures of forms can be acquired by continued observation or attention only. To stimulate attention, we use various devices, e.g., modelling,

drawing, experiments, questions and pictures. The carefully moulded forms, the accurate drawings, the correct answers to questions should not be the end sought, and can never supply the place of nature. If the device be made the end, pupils will never see beyond the mere form of expression. Devices are merely means by which the teacher may give direction to investigation, and rivet the attention upon the object of thought or study. As the aim of the lesson is to awaken mental activity, count that device best which demands closest observation and original investigation, and which for the longest time incites the mind to exercise.

Wait patiently for the children to *grow* to the answers. Let them have the joy that springs from the discovery of a truth by their own efforts. The best lesson is not that which elicits the greatest number of answers, but is that which stimulates the deepest thought.

The District. — To illustrate the study of a district, a neighborhood has been selected whose hills, valleys and brook-basins have become familiar from having so often tramped over them with little pupils. The elementary work on land and water forms, here outlined, should extend through at least *two years*, as indicated by the course of study in the appendix, and may be begun in the third grade or beginning of third year in school.

Although the class may have had simple lessons upon hills, ponds, clouds etc., and may have learned to state the direction of one body from another, together with other lines of work indicated in the chapter on the First Two Years, these steps should be gone over once more to find out just what has been done. The best way to examine a class is by teaching it a new lesson, and observing what power and knowledge the pupils can bring to bear. The aim will be to

develop the perceptive faculties and expression together, each re-acting to strengthen the other; and thus lay the basis for vivid imagination and accurate reasoning. Moreover, they may at the same time study such facts as will best prepare them to imagine the surface of the whole earth with the forces at work upon it. The following list of forms was suggested by the school district on p. 73. It is not intended as an order to be followed, but rather to indicate what *types* are to be found in a small district. A valuable rule, however, which the teacher should observe is this: *Each lesson should be based on those that have already been given.*

I.—FORMS OF LAND AND WATER.

HILL or MOUNTAIN. — Side, slope, gradual, abrupt, length, height, top, summit, peak, bluff, precipice, group, range, system. VALLEY. — Meadow, marsh, swamp, plain, marine plain, gorge, pass, canon. BROOK or RIVER. — Banks, right and left, bed, channel, current, rapids, waterfall, spring, hot spring, geyser, glacier, moraine, source, mouth, delta, estuary, alluvial plain, bottom land, tributary, system, water-parting or divide, basin. POND or LAKE. — Bed, basin, shore, head, foot, inlet, outlet. TABLE-LAND or PLATEAU. — Desert. VOLCANO. — Crater, lava.

COAST. — Shore, beach, cape, promontory. ISLAND. PENINSULA. — Isthmus, neck. HARBOR. — Port, haven, road. BAY. — Gulf, sea. CHANNEL. — Strait, sound. OCEAN (?) — Tide, current. CONTINENT (?).

Immediately after presenting a form of land or water, some teachers prefer to give the various names applied to that form in different countries: e.g., when "plain" has been taught, the names prairie, savanna, steppe, lande, llano and pampas are given; and with "marsh", they teach the words

moor, bog, fen, morass and tundra. As the pupils know little, if any thing, of the countries in which these are found, and do not at present need the foreign names, would it not be better to merely mention at this time the fact that other people use different names, and defer teaching them till they are required? The aim at first is rather to teach the thing itself than its many names.

Suggestions. — The first lesson at least upon each form should be given where the pupils can distinctly observe it in nature. If it is absolutely impossible to take a field-trip, use a sand-table and solar camera with blackboard sketches and many pictures. Let the pupils *discover* the answers, and be careful to include no part of them in the questions. Let all questions be definite, that the children may know what to look for; and as our object is to lead them to observe, require as many different answers as possible to each, as evidence of individual observation. Concert recitation is an excellent means of "showing off" quick pupils, and depriving slow ones of all opportunity for thought; but it has no place in a teacher's work who seeks to reach the individual.

Wait for the slower minds to work, and as a rule allow them to state the answers, for the ready intellect needs not this stimulus. Avoid training to stilted form of expression. Let it be perfectly natural. If the question calls for a complete statement, require the same, but if it suggests the omission of a portion, allow it. Look rather to the manner of asking the question, and so frame it that the child's thoughts will call for complete sentences in expression. Errors in spoken as well as in written language should be corrected while the picture is in consciousness, in order that the correct expression may be associated with its corresponding mental state.

Pupils should take note-books into the fields for the purpose of sketching and recording their discoveries, thus tending to fix them in memory. Teach but few facts in each lesson, and those few thoroughly. Give new names as soon as the forms are clearly perceived. Show the written form of each new word, and pronounce it distinctly when first used. This should be the rule in all subjects, as it prevents wrong or invented spelling from becoming lodged in memory.

Decide what objects to teach before going on a field-trip, but allow the class to direct the observation as far as possible by their own questions. Let pupils who have discovered facts question the others, to lead them to observe the same. This is an excellent device for inciting to original seeing. Moreover, the framing of the questions greatly intensifies accurate perception. *Definitions of all geographical forms should be discovered by the pupils, and never told them.* Leading a class to *discover* a definition of, e.g., a hill, is a very valuable device for supplementing the work of modelling and drawing the same form. Defining or describing necessitates careful observation and comparison of forms. As well may the teacher or rather teller model, draw and write every thing for a child, as make such descriptions. The proper use of defining is not to train parrots, but to develop the perceptive, generalizing and descriptive powers of our pupils. Effort alone is the soil of growth.

Too great importance cannot be attached to the value of carefully preparing each lesson before presenting it to the class. The teacher's efficiency is thereby more than doubled. Moreover, children have a right to expect carefully prepared mental food, and it is a mark of intelligence that they rebel against a daily fare of cold, dry facts. A few lessons are here reported in full to illustrate one way of presenting the

subject, and a manner of using the various devices. It is not intended that the forms of land and water shall be taught in the order outlined above. This arrangement was suggested by the school district which has been selected for a model. The more familiar forms should be presented first; but we should aim to preserve as far as possible a natural *sequence of subjects*, and yet to introduce sufficient variety to maintain interest.

It may be noticed that the chief aim of these illustrative lessons is not to associate names with forms and forces, for that would be mere language work which, although important, should be made secondary to leading the pupils to *discover the simple laws of drainage. Each lesson should grow out of the preceding one, in order that continuity of thought may be developed.* Give ample opportunity for the imagination to express its forms and combinations by modelling and drawing, that the synthetic or inventive power may be cultivated with the analytic or critical; e.g., after pupils have modelled a particular hill or valley, let them make any other similar forms which they can find in their district or in pictures, and also combinations of the same.

Just as soon as a common form has been carefully studied, the pupils should be led to think of larger and grander forms of the same kind in distant lands. Thus, when they have studied the brook-basin, the teacher should tell stories, show pictures and let them read of some great river-basin, e.g., the Amazon, to cultivate the imagination, and to prepare for the study of the unseen world. This is one of the most important steps in all the work, and should not be neglected. (See p. 67.)

Attention is once more called to the suggestion that the questions on water, soil-making, plants, animals etc. be

studied in connection with the lessons on the forms of land and water. Let all the elementary work centre in the *slopes* as illustrated in the various district forms. The geography of the whole earth is graven in every brook-basin.

ILLUSTRATIVE LESSONS.

Lesson on Slopes.

AIM. — To lead the pupils to discover that the surface of the earth is composed of gradual and abrupt slopes.

PREPARATION. — Pupils have studied a hill, and modelled it during a previous field-trip. Each now has a model-tin and sand. The teacher uses a large sand-table.

Teacher. — "We will all model the hill upon which the schoolhouse stands. Down which side of our hill would you rather slide on your sleds?"

First Pupil. — "I'd go down the steep side, because I could go swifter." — "Could go more swiftly," corrects the teacher, and the pupil repeats the sentence.

Second Pupil. — "I would rather slide on the long side, because I could go farther."

Third Pupil. — "We shouldn't have so far to walk back on the steep side."

Fourth Pupil. — "But it would be harder to climb there."

Fifth Pupil. — "On the steep side we could slide oftener."

Teacher. — "Can you give me another name for the side of a hill?" After waiting a moment, as no answer is given, the word "slope" is written upon the blackboard by the teacher, and pronounced by the pupils. The teacher then asks, "How many slopes has this hill?"

Pupils. — "It has two, the long and the short one."

"There are slopes between them two." — "Between those two," is repeated.

"It has slopes all around it."

"It slopes in every direction."

"One slope goes all around the hill."

Teacher. — "Have you ever seen any land that doesn't slope?"

Pupil. — "Mr. J.'s meadow is just level."

Teacher. — "What becomes of the rain that falls upon this meadow?"

Pupil. — "It must flow into the brook."

Teacher. — "What causes it to flow there?"

Pupil. — "The land must slope just a little, but we can't see that it does."

Teacher. — "What becomes of the water after it reaches the brook?"

Pupil. — "It flows out across the marshes."

Teacher. — "Are there any other places which you think are level?"

Pupil. — "The marshes must be level because the water stands in ponds and does not flow off."

Teacher. — "Why doesn't the water spread all over the marshes, and make one large pond?"

Pupils. — "The ponds are in little hollows."

"The land between the ponds is too high."

"The surface must slope a little towards the ponds."

Teacher. — "Slopes like those in the marshes, meadow and street in front of the school, we call 'gradual slopes.' You may copy the words into your note-books from the blackboard. Now tell me where you have seen other gradual slopes." The pupils name many of the fields and streets in the vicinity.

Teacher. — "Now model, please, a field having only gradual slopes and a brook. With your ruler cut the field into two parts *across* the brook, and remove one part. Now see if the water from the slopes would run into the brook." After seeing that all have modelled it correctly, the teacher requests them to model the school hill again. This is to direct the thoughts of all back to the two slopes.

Teacher. — "What name shall we give to the other slope?"

Pupils. — "It's a sudden slope."

"We may call it a 'steep slope.'"

Teacher. — "Yes, or an 'abrupt slope.' Copy this word also, please, as I write it. Where have you seen abrupt slopes?" They give many illustrations.

Teacher. — "Each may model a perfectly level field. What would be the result if all the fields were like these?"

Pupils. — "There wouldn't be any slopes."

"We couldn't slide down hill."

"The rivers would stand still."

"The water couldn't form rivers."

"The land would be covered with water."

"It would be muddy everywhere."

"The ocean would flow over the land."

"There wouldn't be any land to live upon."

Teacher (modelling a group of mountains). — "What if the surface were made of abrupt slopes?"

Pupils. — "We shouldn't have any meadows and marshes."

"All the rivers would be very rapid."

"Ships couldn't sail upon them."

"The water would soon make great gullies in the slopes."

To close the lesson, the teacher took the class on a very simple imaginary trip up the Ganges to the Himalaya Mountains, telling that it lies far to the eastward, nearly half way

round the earth; modelling, describing the river-basin, and pointing out its location upon a wall-map. Although the pupils had not, of course, studied Asia, and could remember but little of what was told, they gained in power to enlarge the seen into the unseen.

Two Lessons on Brooks.

FIELD LESSON. — Class, with note-books, near the brook.

AIM. — To interest the pupils in observing brooks, and to teach *current*, and *up* and *down stream*.

Teacher. — "In what direction does the brook flow?"

Pupils. — "Towards the pond."

"It runs away from us." — "Does it?", asks the teacher, pointing up stream.

"Oh, it runs towards us, too."

"It flows towards the south-west."

"It flows under Pitt Street."

"It runs down hill."

Teacher. — "Where did the water come from?"

Pupils. — "The rain brought it."

"It come from Mr. K.'s meadow." — "It came," adds the teacher.

"It flows from a little spring near Squantum Street."

"There are two little springs near those trees."

"The clouds brought the water."

"I think it came from the sides of the hill all around us."

Teacher. — "Where is it going?"

Pupils. — "It flows into the pond."

"But it flows out on the other side."

"I think some of it dries up."

"It flows through the salt marshes."

"The brook empties into the Neponset River."

"And that flows into the ocean."

Teacher. — "What moves that little stick in the brook?"

Pupils. — "It floats along on the water."

"The water carries it."

"It swims on the water."

"The motion of the water makes it go."

Teacher. — "What do we name this motion of the water?" No pupil knows, so the teacher gives the name "current," and tells them to write it in their note-books as he spells, "c-u-r-r-e-n-t." Looking at the written word, the pupils pronounce it. The teacher directs them to throw several sticks or leaves into the water, and then asks, —

"Is the current the same in all parts of the brook?"

Pupils. — "The sticks hardly move near the shore."

"See how swift they go out there." — "See how swiftly," suggests the teacher quietly.

"The current is swiftest in the middle."

"There ain't much current near the shore." — "Isn't much," etc.

Teacher. — "We will follow the sticks a short distance, and see how swift the current is. Does the water flow up, or down?"

"Down," sings the chorus.

Teacher. — "Point down stream; up stream. Now you may all sketch the brook from the little spring to the pond, and show the direction of the current by an arrow."

When this is finished, the class is dismissed, as it is now noon. Long after the teacher has returned to the school, the children linger by the brook, throwing in sticks, or watching the water bubble from the little spring; and he knows that the chief object of the lesson is accomplished, — the children are interested in running water.

In the afternoon, the pupils write what they saw and learned while on their field-trip. The words "current" and "stream" are written upon the board. When finished, the stories are read aloud and discussed. This constitutes their language and reading lesson for the day.

INDOOR LESSON. — The teacher has modelled a brook-bed in clay, sketched several brooks upon the blackboard flowing in various directions, and collected a number of pictures of large and small streams.

AIM. — To review the former lesson, and to teach *bed* and *right* and *left banks.*

REVIEW. — Water is poured into the brook-bed, and the name "current" again applied to it as it flows. Up and down stream are also recalled by the direction of the current. The teacher then asks, —

"What remains here after the water has flowed out?"

Pupils. — "The place where it flowed."

"There's a long trough."

"The bottom of the brook is there."

Teacher. — "What shall we call this part in which the water *lies?*"

Pupil. — "We might call it a 'bed.'"

Teacher. — "That is its real name. What holds the brook in its bed?"

Pupils. — "It's in a little valley, and can't flow over the sides."

"The sides hold it in."

"It would overflow if you should make a dam across it."

"Sometimes it does flow over after a rain-storm."

"There isn't enough water now."

"The banks are too high."

As the word "bank" is so common, it is only necessary to use it before the class to fix it as the name of the land along the brookside.

Teacher. — "How many banks must a brook have?"

Pupil. — "Two."

Teacher. — "Point up the brook, — down," referring to the one in clay. "Point down each brook upon the blackboard, — in these pictures. If you were facing down stream, which banks in the pictures would be on the right?"

The pupils indicate them by pointing.

Teacher. — "We will always call these the 'right banks.' How can you decide which is the right bank of a stream?"

Pupil. — "Face down stream, and name the one on the right hand, the right bank."

Teacher. — "Point to all the right banks in the pictures; the left banks. Draw four brooks flowing in different directions; make arrows pointing down stream, and write the names of all the banks in their proper places."

The teacher closes the lesson by reading to the class Tennyson's beautiful idyl of "The Brook."

First Lesson on Brook-Basins.

Aim. — To lead the pupils to discover in the brook-basin how the rainfall of a continent is gathered into rivers, and returned to the sea.

Preparation. — The teacher has modelled two adjoining brook-basins in clay, and covered them with a thin layer of loam. In the presence of the class, water is poured upon the basins; and as the little streams follow the slopes, the eager faces and bright eyes announce that the minds are active and ready. The simple device has secured close attention.

Teacher. — "In what direction must a brook flow?"

Pupils. — "It must flow down hill."

"It must follow the valley."

"It always flows from the high places to the low ones."

"It runs down the steepest slope."

Teacher. — "Where does it make its bed?"

Pupils. — "Just between two slopes."

"It must be the lowest part of the valley."

"Where the slopes from both sides meet."

"The bed must lie along the bottom of a slope."

Teacher (sprinkling more water into one of the basins). — "How much land does a brook drain?"

Pupils. — "It drains the whole valley."

"It drains all the land that slopes towards its bed."

"The water flows from the sides of the hills to its bed."

Teacher (sprinkling water upon the top of the ridge that separates the two basins). — "Into which brook does this water flow?"

Pupils. — "It flows into both."

"A part flows into each brook."

Teacher. — "Why doesn't it all flow into one?"

Pupils. — "Because it can't flow up hill."

"It must flow down the slope."

"The land is too high between them."

The teacher now points to different parts of the highland, and asks to which brooks the slopes belong. The pupils answer readily until the finger rests upon the water-parting, and the class is in doubt. One little girl suggests, "It might flow down either side."

Teacher. — "Can you point to any other places like this?" and eager fingers begin to trace the line.

Teacher. — "To which valley does that line belong?"

Pupils. — "It doesn't belong to either."

"It belongs to both."

"It separates the valleys."

"Both valleys begin at that line."

Teacher. — "On which slope is this line?"

Pupils. — "It comes just between the slopes."

"It is on both slopes."

"This line is just where the slopes meet."

Teacher. — "Does any one in the class know what we call such a line as this?" As no one answers, the teacher writes the word "divide" upon the blackboard, at the same time pronouncing it, and then asks, "Why is it called a divide?"

Pupils. — "Because it divides the land into two valleys."

"Because it separates the slopes."

"It turns the rain in two directions."

Teacher. — "For this reason we sometimes call it a 'water-parting.'" This name is also written. After indicating on the map, and describing the low water-parting between the Amazon and La Plata, the class is dismissed.

Second Lesson on Brook-Basins.

Aim. — Same as in previous lesson.

Preparation. — Each pupil has a model-tin and sand.

Teacher. — "Make three valleys, please, side by side, and trace a brook-bed in each. Now trace the water-parting around the middle valley." The teacher passes up and down the aisles to see that all understand, and then adds, "We often call a valley a 'basin.' If it is small, and contains a brook, what kind of a basin might we name it?"

"Brook-basin," suggest the pupils.

Teacher. — "If it contains a river? pond? lake? ocean?"

The pupils readily name them.

Teacher. — "Look at your brook-basins, and tell me the difference between a water-parting and a brook-bed."

Pupils. — "The bed is in the bottom of the basin; the water-parting, at the top."

"The water-parting separates the water; the brook-bed collects it."

"The upper edges of the slopes are water-partings; the lower edges, brook-beds."

"The water-parting runs around the basin; the brook-bed cuts across."

"The water-parting surrounds the valley; the brook-bed runs around the base of the hill."

"The water-parting is a ridge; the brook-bed, a trough."

Teacher. — "Make now, please, a basin containing a brook and three tributaries." ("Tributary" has been taught.)

"Trace the water-parting around each tributary. How many streams drain the whole basin?"

After some discussion, the class decides that, as the tributaries join the brook, there is really but one main stream with many branches, like a tree-trunk and branches. The teacher then adds, "All the streams within one basin we call a 'system,' a 'brook-system,' or a 'river-system.'"

Teacher. — "What is the difference between a basin and a system?"

Pupils. — "A basin is land; a system is water."

"A basin is made of slopes; a system, of streams."

"The system drains the basin."

The pupils make cross-sections of their models (see map on p. 73), and draw them in their sketch-books, placing the names "water-parting," "brook-bed" and "slope" in their appropriate places.

For imagination work, the teacher gives a short account of the voyage of Marquette down the Mississippi.

To awaken the sensibilities and link them to nature, the following beautiful poem by Longfellow is read in closing the lesson: —

THE BROOK AND THE WAVE.

"The brooklet came from the mountain,
As sang the bard of old,
Running with feet of silver
Over the sands of gold!

"Far away in the briny ocean
There rolled a turbulent wave,
Now singing along the sea-beach,
Now howling along the cave.

"And the brooklet has found the billow,
Though they flowed so far apart,
And has filled with its freshness and sweetness
That turbulent, bitter heart!"

This beautiful gem is well worthy of a place in memory's casket.

Third Lesson on Brook-Basins.

Aim. — To study in detail a particular brook-basin, and to correct erroneous ideas if any have crept in.

Preparation. — Class with model-tins down by the meadow brook.

Teacher. — "Point toward the north, south, east, west; north-east, south-east, south-west, north-west. Describe the slope west of the brook, please, Maude."

Maude. — "The slope is at first gradual. Then it is very steep for about fifty feet, and on the hill is gradual again."

Teacher. — "Describe the slope toward the south, please, Flora."

Flora. — "The slope to the south is gradual just as far as we can see it."

Teacher. — "The northern slope, Helen."

Helen. — "The northern slope is gradual also, almost to the head of the brook. There it becomes more abrupt near Squantum Street."

Teacher. — "The eastern, Grace."

Grace. — "The eastern is like the western, except that it is longer."

Teacher. — "You may all follow the west slope until you reach the water-parting. Now you may follow the water-parting around the basin to the opposite side." This journey completed, the pupils take positions along the abrupt slope, overlooking the valley, and model the entire brook-basin. This completes the lesson. On the way back to school, the teacher describes the water-parting of the Mississippi basin.

Fourth Lesson on Brook-Basins.

Aim. — To study the slopes of the basin.

Preparation. — Each pupil has a sketch-book, model-tin and sand, in the class-room.

Teacher. — "You may model the brook-basin just as you did yesterday. Mark the water-parting and brook-bed on your models. Now show the water-parting by a dotted line in your note-books; also draw the brook. Show all steep places in the slopes, by shading" (see map on p. 73).

This was the drawing lesson for the day.

First Lesson on Delta.

NOTE. — Before leaving the school, the teacher, in the presence of the class, stirs some mud in a glass of water, and sets it on a table.

AIM. — To teach how deltas are formed.

PREPARATION. — Class with note-books near a part of the brook where the current is rapid, while just above and below it is very slow.

Teacher. — "What difference can you see between the brook here and down there?"

Pupils. — "The water is swifter here."

"The brook is wider below, and the water hardly moves."

"The bed is steeper here."

"Here the bed is rocky, but down there it is muddy."

Teacher. — "You may stir this yellow clay in the water above, and watch it carefully. Tell me all that takes place."

Pupils. — "The water is all muddy now."

"It is so muddy that we can't see the pebbles where it is so rapid."

"Down there the muddy water moves very slowly."

"It is spreading toward both banks."

"The mud is settling to the bottom below the rapids."

"The water is clearer now."

"The clay is covering the black bed all over."

Teacher. — "Now look at the rapids."

Pupils. — "The water is clear again."

"The clay couldn't stop there."

Teacher. — "Why not?"

Pupils. — "The water washed it down."

"It is too swift there."

Teacher. — "Now stir some gravel into the rapids."

Pupils. — "The pebbles sink, but the sand goes down stream."

"The sand is settling down there."

"It is making a little bank just below the rapids."

"It don't go so far as the clay went." This is corrected by "It doesn't go."

Teacher. — "Our time is past, and we must return now." On the way back, the teacher threw a handful of gravel into the wind, merely exclaiming, "Look!"

Pupils. — "The pebbles came straight down."

"The wind carried the sand a little way."

"The dust is still blowing."

Teacher. — "Now the air is still. I will throw some more."

Pupils. — "It all came straight down."

"The dust staid in the air a little while."

Returning to the schoolroom, they find the glass of water is clear again, and the mud spread in the bottom of the glass.

Second Lesson on Delta.

The teacher takes the class to a street gutter near by, where a recent rain-storm has washed the sand from the banks, and formed little deltas all along the sides.

Teacher. — "What made those little sand-banks?"

Pupils. — "The water must *uv* made *um*." "Must have made them," corrects the teacher, quietly.

"It washed down from the sides."

"They settled from the water."

"Why, we made one in the brook like these!"

"Here is a little valley in the bank where the sand washed out."

"It takes quite swift water to carry sand."

"The water on these banks would be swift."

"The water in the gutter don't flow swift enough to wash it away." "Don't" and "swift" are replaced by "doesn't" and "swiftly;" then the sentence is repeated.

Just as long as the children are looking and thinking, even though they are not speaking, the teacher remains silent. When the interest flags, another question is asked, "Are the banks all sand?"

Pupils. — "The top is black loam."

"Here are some pebbles, too."

Teacher. — "Was any of the loam washed down?"

Pupils. — "There is some down there."

"It is spread all along the bottom of the gutter."

"That's just the way it was in the brook."

"And there are the pebbles in the hollows where the sand washed out."

Teacher. — "If I were to throw loam sand, and gravel into a stream of water, which would settle first?"

Pupils. — "The pebbles, then the sand, and then loam," comes the generalization.

Teacher. — "The sand, clay, loam etc., in running water, we call 'silt, — s-i-l-t.' When must a stream lose all its silt?"

Pupils. — "When it stops flowing."

"When it moves very slowly."

"When it flows into water that doesn't move."

"After it has stood a long time like the water in the glass."

Teacher. — "If a brook or river carrying a large quantity of silt flows into a lake, what becomes of the silt?"

Pupils. — "It must settle in the lake."

"It would settle when it reached still water."

"The mud would make a bank there."

"It would spread about the mouth of the river."

Teacher. — "Land made of silt that has settled near the mouth of a stream, we call a 'delta.' Write it in your note-books as I spell, — 'd-e-l-t-a.' In our next lesson, I will show you some pictures of deltas so large that cities have been built upon them. This has been a long lesson, and now we must hasten back to school."

On the day following, the teacher tells of the wonderful deltas of the Po and Ganges.

Suggestions. — The above lessons are intended to illustrate one way of unfolding child-character while leading pupils to observe and study the forms and system of natural drainage of their district. Much more about brook-basins and deltas remains to be discovered by the pupils under the guidance of the teacher; but enough has been given to indicate how by the study of this one neighborhood they may be prepared for the study of foreign lands.

Particular attention is again called to the importance of cultivating the imagination of great natural features of the earth's relief, by describing them to the children as soon as the types have been studied in nature. Thus the little plateau should lead to some greater one, e.g., Thibet; a lesson on the sandy field on a hot summer day should be followed by pictures and stories of the Desert of Sahara; the little peninsula jutting into the pond should call to mind Italy extending into the Mediterranean; the thick grove becomes a great Selva; the meadow broadens to a La Plata valley; the little ravine rises to a cañon of the Colorado, or a great Bolan Pass: in short, every little form becomes the representative of a family of greater natural features, till the whole world lies pictured in the school district.

To prevent the pupils from imagining false location, as they naturally will for every place mentioned, the true one should be described as nearly as possible, — its direction at least from the school being indicated. It is perhaps advisable to locate such places upon maps, as the children are, in a measure, thus taught to associate their concepts with the map signs. The suggestion is not that *all* the plateaus, deserts etc. should be described and located at this time, but only one or two of each. The chief aim should be to develop the power of imagining great unseen forms, and not the mere memory of locations.

Another important element is worthy of especial notice here, viz., the use of gems of poetry as a means of leading the children to a more reflective and refining study of nature. Little forms whose beauty and lessons lie hidden deep are oft unveiled at the touch of the poet mind. These lessons sink deepest when we are drawn nearest to nature in study. Thus that which first inspired the poet's thought becomes the language by which we interpret it.

What a companion we find in the moon when its full shining face calls up the voices of the past to tell how —

> "Hesperus, that led
> The starry host, rode brightest, till the moon,
> Rising in clouded majesty, at length
> Apparent queen, unveiled her peerless light,
> And o'er the dark her silver mantle threw." — MILTON.

> "Heaven's ebon vault
> Studded with stars unutterably bright,
> Thro' which the moon's unclouded grandeur rolls,
> Seems like a canopy which Love hath spread
> To curtain the sleeping world." — SHELLEY.

"In full-orbed glory yonder moon divine
Rolls through the dark blue depths;
Beneath her steady ray,
The desert circle spreads
Like the round ocean girdled with the sky.
How beautiful is night!" — SOUTHEY.

How often have our thoughts been turned inward and backward when evening has recalled such beautiful lines as, —

"Silently one by one, in the infinite meadows of heaven,
Blossomed the lovely stars, the forget-me-nots of the angels."

Or, —

"The night hath a thousand eyes, the day but one,
And the light of the whole day dies with the setting sun.
The mind hath a thousand eyes, the heart but one,
And the light of the whole life dies when love is done."

As the pupils study each form of land and water, read to them or have them read what the poets have said about it. This line of work affords an excellent opportunity to cultivate a taste for choice literature, which must surely aid greatly in shaping the pupil's whole life. Reach out toward the minds of childhood, and mould the desires for that which is good and true. Draw this veil of purity about their young lives. Weave into their forming characters the noblest thoughts of the noblest men and women, and unless their minds are already warped and narrowed by years of low reading, they will naturally incline to that which is pure; for to see truth is to love it.

What companions the children shall choose in life becomes then a question of grave responsibility with the teacher; and there seems to be no better way to guide this choice than

to give them early companionship with nature's poets and authors. A few of the purest gems should be committed to memory, as they will surely exert a beneficial influence in the culture of the sensibilities. Select only the simplest and choicest, and above all preserve the interest.

2. MAPPING THE DISTRICT.

Map-reading is one of the most important objects of geographical teaching. Before a pupil can read a map, he must become familiar with the features represented, and must have associated with each of them its corresponding sign used on the map. As a preparation for such reading, the pupils should draw such a portion of their school district as includes the principal forms of land and outlines of water in their various relations, making use of signs similar to those on their printed maps. Association is thus made between the concepts and their corresponding signs, so that the latter upon a map will recall the former, and enable the child to approximate the reality. Then, too, the effort of measuring great distances by pacing, and of reducing to a very small scale aid greatly in comprehending the vastness of the area included in an ordinary map.

During the study of the forms of land and water, the pupils have doubtless modelled and drawn much of the district; and the principal work now will be to reduce all to a scale of representation. A simple explanation of the scale may have been found necessary in the preceding work; but not a detailed study of it, such as follows in this step.

We may map the district by both modelling and drawing. The former, being much the simpler, naturally precedes, and prepares chiefly for reading relief maps, while the latter paves the way to contour-reading.

The Scale. — Select two objects, and measure the distance between them, e.g., two trees eight paces apart. Call attention to the difficulty of drawing so long a line upon paper, and ask the pupils to draw one, allowing one inch for each pace; then one-half and one-quarter inch. Give many exercises of this kind, using different scales. Let an inch take the place of a yard, then four paces, etc.; but let every drawing represent a real distance.

Next combine distance and direction. For example, a fence runs due north and south, and is twenty-four paces long. Fix upon one side of the paper as north, and then draw the line, allowing one-eighth of an inch to a pace. Again, north-east from a certain tree there is a large stone, distant sixty paces. Draw the line joining them, upon the scale of one-third of an inch to ten paces. Then represent the boundaries of surfaces: e.g., the top of a table eight by four feet, scale one-eighth of an inch to a foot; or a field two hundred by sixty yards, upon the scale of forty yards to an inch.

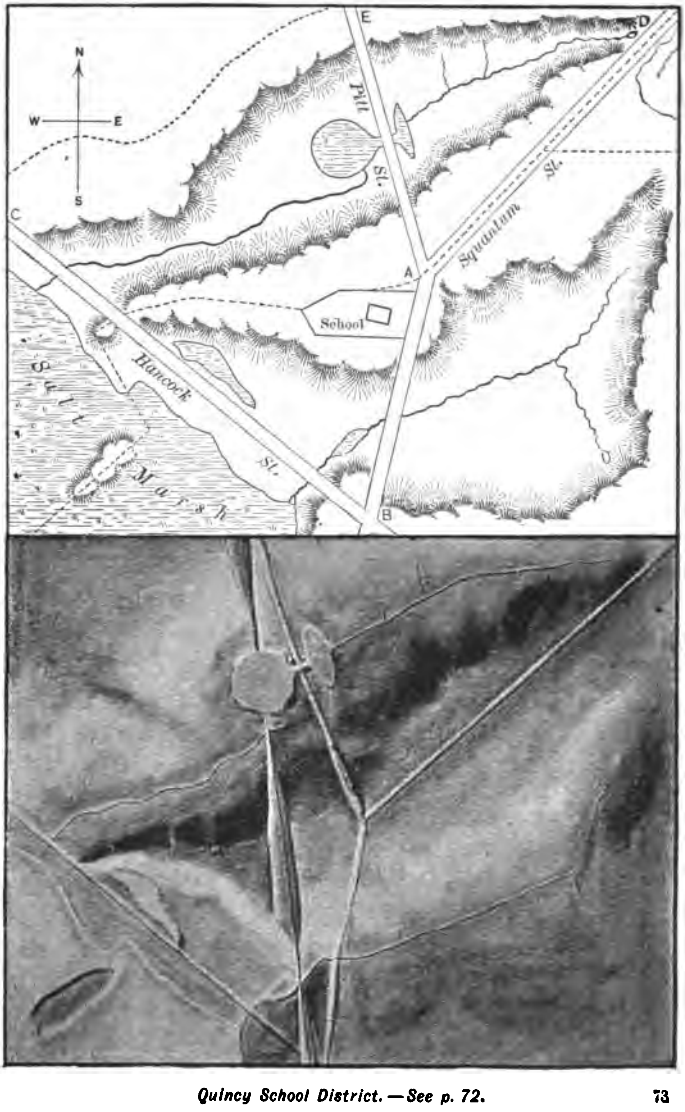
Finally give exercises combining lengths and relative directions of boundaries. One problem may be to draw the schoolroom, using the scale of one-eighth of an inch to a foot, locating doors, windows, desks, platforms etc.; then re-draw upon a smaller scale, e.g., one-tenth or one-sixteenth of an inch for the same distance. Follow by a plan of the whole floor of the building on the scale of, for instance, one-eighth of an inch to a yard. As greater areas are included in the drawings, reduce the scale. In platting the yard and district, the pace may be made the unit of measure. Employ similar devices also in *modelling* groups of natural features of relief. When the use of the scale is understood, we may begin the work of mapping the neighborhood.

Modelling and Drawing the District. — As has already been stated, the modelling and drawing should be used together, the former leading rather to observe elevation and surface-slope, the latter, outlines of forms. The devices combined afford the necessary opportunity of associating the signs of the map-language with their appropriate ideas, — thus preparing the pupils to read foreign maps which are merely new relations of the familiar forms of our school district. This shows the necessity of employing the same map-language as that contained in the text-books.

Such a part of our district has been selected as will include in our maps the two brook-basins in which we have already discovered how the land is drained, and the types of all land and water forms. This accords with the previous statement (p. 45) that we should study such portions of our district as contain the forms, forces and conditions that should make up the child's world-picture.

Lesson I. — To determine the bounds of the maps, the pupils first locate Squantum Street (see maps, p. 73), running by the school-yard towards the north-north-east. They then walk north-north-east to Pitt Street which they find enters Squantum fifty paces from the school-yard. These facts are carefully recorded in the pupils' note-books. This junction of streets at A, we select for a starting-point. From A, we discover that Pitt Street extends towards the north-north-west, that Squantum Street bends to the north-east, and the portion that passes the school-yard runs towards the south-south-west.

The pupils are now separated into three groups for pacing in the three directions. One party is instructed to pace Pitt Street to the water-parting, E, beyond the pond; another, Squantum Street to the springs, D; the third, to Hancock



Quincy School District. — See p. 72.

Street, B. All the pupils will not, of course, return the same number of paces for the same distance, but we may use the average. Every member of the class is required to pace one of these distances, in order that the maps which are to be made on a small scale may vividly recall the large area included. The efforts made in walking the distance, and the accompanying sense of fatigue are the best means of impressing the dimensions.

It may not be amiss to note here, in the same connection, that muscular effort may often be made a means of attention to forms and motions. For example, a class of so-called "mischievous" boys, possessing such active minds and bodies that the teacher had not given them enough work to keep them busy, and to whom fun was merely a safety-valve to their pent-up spirit of activity, received many of their most impressive lessons by giving vent to their restlessness under proper guidance. Thus, when all other devices had failed to stimulate their observation to the degree of slope of a certain hillside, they were allowed to race at full speed from the foot to the top, and then to walk *slowly* down. No further exercise was needed to impress them with a sense of the abruptness of that slope. At another time their attention to the current of a brook was secured by requesting them to throw sticks into the water, and walk for a long distance down stream, keeping just abreast their tiny crafts, thus varying their own speed to correspond with the current in different parts of the brook-bed. An ounce of tact is worth a ton of rod.

But to return to our mapping. The returns make Pitt Street four hundred and fifty paces; Squantum, six hundred paces to the springs, and four hundred paces to Hancock Street. The whole class now paces from B to the little

bluff C, beyond the brook, and find it to be six hundred paces. Hancock Street extends due north-west and south-east.

Returning to the school, each pupil constructs an outline map of the included district, on the scale of twenty-five paces to one-eighth of an inch. First, a compass card is drawn in one corner of the paper, indicating at least the cardinal directions. A point is then fixed upon for A, and from it Squantum Street is drawn north-east (six hundred paces) three inches, south-south-west (four hundred paces) two inches; Pitt Street north-north-west (four hundred and fifty paces) two inches and a quarter. From B, Hancock is also added north-west (six hundred paces) three inches. A rectangle is next drawn, enclosing these streets by lines extending due north and south, and east and west. From measurements already made, the school-yard may be drawn fronting Squantum Street (fifty paces) one-fourth of an inch from A. The moulded map may be made on the scale of ten paces to one-eighth of an inch on the model-tins.

Thus far we have located artificial bounds only, but in our next lesson the streets will serve as base-lines for measuring and locating the natural features.

Lesson II. — Starting out again with note-books, on the next pleasant day, we record the following observations and measurements: Squantum Street slopes downward from A toward Hancock, two hundred and fifty paces to where a little brook flows under the road. From this point, the street rises gradually towards B. We follow the brook east-north-east three hundred paces to the spot where it turns abruptly to the right, continuing one hundred and fifty paces farther to a beautiful spring.

A small tributary joins the brook at the bend, flowing from

the north-east about a hundred paces. After passing under Squantum Street, it widens into a little pond; thence continuing under Hancock a hundred paces from B, it finds its way across a broad salt-marsh to the Neponset River, which can be seen in the distance, flowing towards Boston Harbor. Our modelling and drawing lessons for the day consist in adding these observations to our maps.

Lesson III. — On our third trip, we locate the second and larger of the two brooks. Pitt Street slopes two hundred and fifty paces to the middle of a little pond that lies along both sides of the road a hundred paces. From here, the brook extends north-east a hundred and fifty paces, then bends east-north-east for the same distance, and finally bears due east two hundred and fifty paces to its source near Squantum Street (D). Two little springs empty into the brook from the right bank, one seventy-five paces and the other a hundred and fifty paces above Pitt Street, both rising about twenty-five paces from the brook. After reducing all to the scale, these are also modelled and drawn upon the maps.

Lesson IV. — After passing under Pitt Street, and out from the little pond by the roadside, the brook flows into a round basin, making another pond a hundred paces across. Finding an outlet on the south-east side of the pond, it runs toward the west-south-west across a narrow marsh, flows under Hancock Street a hundred paces from the ridge C, and finally, after winding about the broad salt-marsh, joins the other brook, and flows with it to the river. In tracing the brooks, we have now located the *lower edges* of all the slopes in the map district. More careful observation and discernment are necessary in locating the upper edges or water-partings which next engage our attention.

Lesson V. — The pupils have studied water-partings in their previous lessons on the Forms of Land. Our work now is to trace them by careful comparison of slopes and levels, and then to locate them by direction and distance from some lines already fixed upon the maps. The water-partings are indicated by dotted lines. Starting once more from A, we find that Squantum Street follows the ridge (between the brook-basins) towards the north-east three hundred paces; but that here the water-parting divides to admit a third basin which drains the land beyond this point east of Squantum Street, carrying the water into a large bay about a quarter of a mile distant. This latter basin is separated from the west brook by the parting which continues along Squantum Street, and from the east brook by the little ridge which extends due eastward from the same street.

Lesson VI. — Returning to A, we next trace the upper edges of the slopes towards the south-west, across a field to the middle of the north side of the school-yard; thence it follows the fence westward, and continues with a slight curve across Hancock Street, two hundred paces from the ridge C. After a sharp turn towards the south-south-east, a hundred and fifty paces, it bends again to the south-west, passing through a little wooded knoll a hundred paces long, and is lost in the great salt-marsh. The water-partings which separate these basins from others to the eastward and westward do not come within the limits of our map, except on the little ridge running from E to C. The pupils should, however, trace them and discover the bounds of the two brook-basins, although they need not be included in the maps.

Lessons VII and VIII. — We have now completed the lines which mark the meeting of the slopes along their *upper* and *lower* edges, and *thus determined the direction of drain-*

age. One other feature should be included, and then our maps will be completed as far as the general surface is concerned. On our many trips, we have observed that the slopes from the water-partings to the brook-beds are not all gradual. In fact, the highland is everywhere a low plateau, through which the brooks in past time seem to have worn their broad meadow basins. The edges of this plateau are marked by low abrupt slopes which it will be our next work to locate. This may be easily done by following the brooks from their sources, and making measurements to the low bluffs every fifty or one hundred paces, or wherever it is made necessary by any change of direction. The abrupt slopes may then be modelled, and represented on the outline maps in a simple manner by shading (*hachures*).

Other features may now be added, e.g., the little pond along Hancock Street, south-west from the school; the path leading to the school-yard from the same street; the woods near the head of the east brook. The relief and outline maps on p. 73 serve to indicate what may reasonably be expected from the class.

After modelling the district accurately, *various cross-sections should be made and drawn.* This is an excellent device for directing the attention more closely to the slopes and their limitations. It may readily be seen that every map including a large area must, of necessity, be constructed on a double scale of altitude and horizontal extension, to make slope perceptible to either touch or sight. Our plateaus being only about thirty feet above the marshes over which the tide-water flows, it would be very difficult to keep the true proportion of height to width; hence, we have an excellent opportunity to illustrate the exaggerated scale upon which all maps of continents are constructed.

The relief map has been modelled on the scale of one-eighth of an inch to ten paces. The cross-sections may now be added on the scale of one-eighth of an inch to ten feet of altitude. These sections may be made from field-trip observations, by cutting through the moulded map, or by the aid of both, and should be added to the district map. The section in the illustration is made from E to B.

Finally, have each pupil write a careful description of the surface of the district, locating the principal slopes, highlands, basins etc.; also noting the nature of the surface, whether covered with rocks, sand or loam, and whether wood, grass, or garden land. Attach the maps to the descriptions, and file away for further additions when studying vegetation and animal life.

No portion of the whole system of geography is more important than that just completed; for if rightly presented, the child now holds the key to the relief and drainage of the whole earth. Although the mapping has probably occupied less than a month, the time would have been comparatively profitably spent had it required a whole term for this work; for if well done, it will save more than that length of time in future study.

So far as relief and outline are concerned, the pupils are now ready to study the maps of the continents. They have not only become familiar with the forms represented, but have also learned the *map-language*. Each foreign map is now a series of sentences; each sign is a word to recall its corresponding geographical concept; while the arrangement of the signs shows the relations of the forms to each other, and thus represents the continental relief or relations of slopes.

CHAPTER VI.

B.—FORCES.

Suggestions in regard to teaching the forces and motions may perhaps be most clearly illustrated in the form of questions. *Nearly all of the forces can best be studied in the lessons upon the Forms of Land and Water.* (See the Course of Study.) They are classified for convenience merely in selecting. Questions should not be asked for the sake of the answers, but to direct the investigations, and secure attention to the objects of study. They do not outline a course, but only suggest lines of study. No teacher will, of course, follow the order given, or limit himself to the list, as each question involves many others. The best question is the one that leads to closest investigation, and thus becomes a means of mind-growth.

Each question in these lists has in view a later application to the continents, and paves the way to the imagination of the same forces and motions upon a much grander scale, although the same principles are involved. The work should be purely elementary, and does not include the philosophy of the various phenomena, except in so far as the relations may be readily perceived or easily imagined. The answers are omitted here, as they are beautifully and plainly written in nature in every school district.

Allow the children time to make full observations. Dis-

courage hasty answers and quick judgments as evidence of careless thought. Train pupils rather to weigh questions carefully, and judge deliberately. "Snap judgment," so common even among people of maturer years, is largely the product of their early school-training, when a quick answer was demanded as proof of a bright (?) intellect. The mind should never be forced. Give it a reasonable amount of time, and it will not acquire the habit of thinking carelessly, or of being satisfied with partial knowledge.

The first and most important work is to draw upon the past experience of the pupils for the facts which are to be generalized. Where that experience is limited, they should be encouraged to make further investigations, and may be aided in this by questions and experiments. The simplest experiments, such as children can perform, are by far the most helpful. Great care should be taken not to deduce a law from too few facts. The law should *grow* out of the mass of observations, and should not be forced from a few.

In directing the investigations of the pupils, the teacher should keep a definite end in view, some law or series of laws which he wishes them to discover, and should avoid wandering from the subject. The experiments, as well as the observations should be so conducted that the children may discover the truth by perceiving the relations of the objects, and not simply hear it in the explanation of the teacher. Aim to supplement the former experience of every child.

The questions may occasionally be used to advantage as subjects for oral and written language lessons. Those upon Water in the Ocean are, of course, for children living near the seacoast. Encourage the pupils to ask questions. There is no law so simple that we may not learn much in regard to it by watching the minds of little children grow up to it.

1. WATER.

Water Flowing over the Land. — Where does the water in brooks and rivers come from?

Where does it go?

In what direction must a river flow?

Have you ever seen any land that does not slope?

Why are some rivers rapid, others slow?

Why do rivers wind about?

Do rivers drain or water the land?

In what part of a basin must a river make its bed?

Do brooks wind more in a plain or in a hilly country?

Which flow more swiftly, straight or winding brooks? Why?

How much land does a river drain?

Why are some brooks larger than others?

What makes them high or low?

Why do they sometimes overflow their banks?

What are dykes? levees?

Do you know the story of "The Leak in the Dyke"?

How many slopes must a river basin have?

What if the earth's surface were perfectly level?

What bounds every brook basin?

Why are some brooks broad and shallow, others narrow and deep?

Where are they generally widest? Why?

Where do they get their water in dry seasons?

Where is the greater quantity of water, in the bed or banks?

Why are dams built in rivers? How do vessels pass them?

What kind of rivers are best for navigation? manufacturing?

Why do large rivers generally flow by large cities?

What are the uses of water flowing over the land?

Water Flowing through the Soil. — How deep into the ground does rain go?

What stops it? In what direction must it then flow?

Why do not the rains finally fill the soil?

What becomes of the water? Where will it come out?

What is the place called? What does it form?

Why is spring water so pure?

Which do you prefer to drink, spring, well or rain water?

What do plants feed upon?

How is the food brought to them?

How far into the soil do roots penetrate?

Do we find the larger and longer roots in dry or wet soil?

What do plants feed upon in dry seasons?

Which holds moisture longer, sand or loam?

What would be the condition of the soil if the earth were level?

Of what use is the slope of land to plants?

What are the uses of water moving through the soil?

Water in the Air. — Why do ponds "dry up"? Why do tea-kettles boil dry?

What becomes of a basin of water if set in the sunshine?

Do clothes dry more quickly on a windy or a calm day? In the sunshine or shade? On a cold or warm day?

What is the meaning of "the sun is drawing water"?

Why do we sometimes blow upon hot water?

Where do the clouds from locomotives go?

. . . .

Where do clouds come from? Where do they go?

What moves clouds? How fast can they travel?

How high are the clouds?

Do you know the story of "Franklin and his kite"?

Were you ever above the clouds?

Have you ever heard of the "battle above the clouds"?

How can clouds above us be moving in many directions at the same time?

Has every cloud a "silver lining"?

Draw all the forms of clouds that you can see.

. . . .

Where does dew come from? When does it form?
How long does it remain? Where does it go?
Does dew *fall?* Why does an ice-pitcher "sweat"?
Why does moisture (dew) collect on the windows in winter?
What forms the drops of water there?
When can we see our breath? What part do we see?
Why does not moisture gather on hot stoves?
Are all raindrops equally large?
Do you know any signs of rainy and fair weather?
Does it rain harder before or after a bright flash of lightning?
Why is rain fresh when it comes from the ocean?
Why, then, should we bathe often?

. . . .

When do rainbows appear?
In what part of the sky do you always see morning rainbows?
Of what is the rainbow a sign?
Does the bow form before or after it stops raining?
Did you ever see one during a snowstorm?
Did you ever see one near a fountain?
On which side of the fountain must you stand to see it?
Set a tumbler of water in the sun, and see what colors it gives.
What colors can you see in a rainbow?
What are the uses of water in the air?

Water in the Ocean. (For pupils living near the sea.) — How does ocean water differ from river water?

What are tides? How often is it high tide?
Where is the moon during high tide? low?
Of what use is salt in the sea?
How is it obtained from the ocean?
Why does not the river water make the ocean fresher each year?
Do ponds have tides?
Of what uses are storms on the ocean?
What are the uses of the oceans?

Conditions of Water. — Does it ever rain in winter, or snow in summer?

How many rays has every perfect snowflake?

Why do we sometimes bank our houses with snow?

Is a snow house warm or cold inside?

From what do Esquimaux build their huts?

Does the ground freeze deeper when bare, or covered with snow?

Of what use is snow to trees?

Does it become warmer or colder during a still snow-storm?

Is a thawing day warm or cold?

What makes crust form on snow?

When will snow make good balls?

Does snow melt first in a forest or open plain?

Where, then, would floods from melted snow be more likely to occur?

. . . .

In which seasons do we have hail-storms?

What is in the centre of a hailstone?

Are all hailstones of the same size and shape?

What damage is caused by hail?

. . . .

What are the differences between frost and dew?

When and where does frost form?

Does it form on windy or calm nights?

When the night is cloudy or clear?

Why cannot frost form near cracks in a window-pane?

On which side of a building or wall will frost and snow remain the longest?

How can frost "heave" a building?

What effect has frost upon the soil?

What fruits are improved by frost?

What harm is caused by frost? snow? rain? ice?

. . . .

At what temperature is water heaviest? Try it.

Which is heavier, ice or water? Prove it.

What would result to rivers and lakes if ice were the heavier?
Why do pipes burst when water freezes in them?
Why are high mountain-tops covered with snow and ice?
How are icicles formed? What are the uses of ice?

Uses of Water. — **What are the uses of water:—**
In rivers, lakes and oceans? In the soil?
In the air? In springs and wells?
In the conditions of dew, frost, hail etc.? In regulating temperature?
As a means of travel? As a motive-power? In mining?
In purifying the atmosphere? To plants and animals?
In the kitchen? In the laundry? etc.

Intense interest may be aroused in the observation of the various conditions of water by performing a few simple experiments in the presence of the class. A test-tube or bottle of water, a saucer and a lamp are all the apparatus required. Heat the water, and allow the pupils to *record* the successive changes they perceive taking place.

As the water heats, they may observe the rising of the air-bubbles, boiling, evaporation, the formation of clouds etc.; then holding the cold saucer in the vapor or "*water-dust*," they may see dew, raindrops, frost, icicles etc., in process of formation. The work should be very simple, and affords excellent opportunity for language lessons. Mould the expression while the mind is at "white heat" of activity.

Young teachers especially should guard against the fatal error of trying to "explain" the visible effects produced. In nine cases out of ten this arises from a desire to impress their superior wisdom (?) upon the trusting pupils. We should not forget that, although we may seem to float over the explanation by the aid of a few *names* of forces, we

know no more in reality about the strong deep undercurrent of causes than does the child who can wade in but a few steps. Tempt not the little one to trust himself too far on this great ocean of thought in the fragile shell of empty words.

The following statement will bear repetition: viz., Experiments ought not to take the place of the child's past experience, but merely supplement it, and stimulate keen perception and close attention.

2. SOIL-MAKING.

Kinds of Soil. — What is the difference between sand and gravel?

What is the shape of a grain of sand? of a pebble?

What is dust? dirt? What are boulders?

What is the difference between dust and mud?

What colors have you seen in clay?

Where do we generally find clay?

Which is more useful, sand or clay?

What becomes of the plants that die? What is leaf-mould?

Why do farmers often plough grasses into the soil?

What is the color of the richest earth you have seen?

Which allows water to pass through it more readily, sand or loam?

Do plants ever grow upon bare rocks?

In what ways do farmers make the soil richer?

How deep is the loam in your garden?

What is under the loam? under that?

Distribution of Soil. — What makes water muddy?

Which will a brook carry farther, fine sand or pebbles?

Which can carry the greater quantity of silt, a rapid or a slow river?

Which can carry the coarser and heavier?

How far can a stream carry silt?

What is in the beds of sluggish brooks? rapid ones?

Why do river-banks sometimes cave in?

Where do pebbles along the beach come from?

Why are they smooth and rounded?

From what is sand made? How?

What makes rocks crumble?

What cracks large rocks?

Why are coast-lines irregular?

How do jetties deepen a river? (Make one in the brook.)

What becomes of the material washed out?

In what order does running water deposit its different kinds of sediment?

In what part of a brook basin do we find the finest and richest soil?

Why are bottom-lands so fertile?

If a muddy brook empties into a pond, where will the sediment be deposited?

How are deltas formed?

Of what is the soil in a delta composed?

Agents at Work in the Soil.—Why do farmers plough before they sow?

What is the action of frost in the soil?

How deep does the ground freeze?

How does nature loosen the soil each year?

How far into the ground do roots penetrate?

Why do we loosen the soil about roots?

When it rains, does the fine or coarse soil settle below the surface? What brings it back?

Where do the worms come from during or after a rain-storm?

Where do they live? What do they feed upon?

What do they constantly bring to the surface?

Do you know of any insects or bugs that improve the soil?

Of what use are little ant-hills all over a field?

How do bugs and worms get air underground?

As we dig below the surface, does the ground appear to become warmer or colder in summer? winter?

Of what use is the sun's heat in the soil?

Of what use is rain to the soil? snow?

3. AIR.

The causes which determine the *general directions* of the winds of the globe may be referred to a few well-known laws. The same forces are at work everywhere about us, and the daily experience of every child brings him constantly into contact with them. The observation of the motions of air, and the discovery of the laws controlling them, belong to the elements of geography; the application of these laws to the globe, in explaining the causes of the great wind-belts and monsoons, forms a part of advanced work.

Thus a child sees the smoke curl upward from the fire, or he feels a cold draught, and yet may not know or seek a cause. He has made hundreds of similar observations, yet he may not have discovered the simple law of the lighter fluid floating upon the heavier. Or if he has generalized, he may not know why hot air or water is lighter, bulk for bulk, than cold; yet he has seen water boil over in the teakettle, the mercury rise in the thermometer, and many other proofs of expansion by heat resulting in difference in weight between equal bulks of hot and cold fluids. But lead him to classify his observations, — to discover principles or laws, — and he may reason that because air expands when heated, and becomes lighter, bulk for bulk, than the surrounding air, it floats. Thus he, in part, answers the *why*. This may serve to indicate the order in which the subject should be studied.

The teacher should clearly outline in his own mind the causes of the *directions* of the winds of the globe, that he

may be able to decide which, among the many laws relating to winds in general, he must lead his pupils to discover. Those only should be selected which determine *direction.* He next decides what, in the experience of the pupils, illustrates each of these laws, and frames his questions to recall these facts. He also directs them in new lines of investigation and experiment to add to their experience especially where it is quite limited.

Thus the pupils are prepared in the elements which may be used later in the study of the distribution. They can interpret the great forces at work all over the globe only in so far as they have observed them about home, performing the same work in miniature. When the globe, its motions and plan of heating have been studied in the advanced work, the children will readily apply the laws they have discovered, and explain the general circulation of the atmosphere.

The following questions and experiments are intended to suggest one order and manner of presenting the elementary steps in the study of air.

Causes of Motion. — Which is easier, to draw a wagon up hill or down? Why?

Why can you not slide up hill in winter?

Why will a ball roll down hill?

When you throw a stone into the air, why does it not go up forever?

Why do not apples fall upward?

In what direction will water always flow?

Of what use is a spirit-level? What moves the air-bubble?

What substances never fall to the earth?

How large is a pound?

What do we really measure when we weigh any thing?

. . . .

Of what use is a thermometer? weather-vane?

What moves the clouds and raises dust in the street?

When does a windmill turn most rapidly?

What do we breathe in? What is wind?

In how many ways can you discover which way the wind blows?

In how many directions have you seen clouds moving at one time?

What is the difference between a gale and a breeze?

. . . .

Name any substances that are blown about.

Name any that float in the air.

Which of the following will float on water? lead, cork, iron, glass, ice, oil, wood.

Which of these substances are heavier than water?

Why will a cork float, and a piece of lead sink?

Why will not an empty (?) bottle sink?

How can you find out whether a substance will float or sink, without putting it in water?

Which of the following fluids will float upon the other? water and mercury; oil and water; water and air; air and hydrogen; warm and cold air.

When two fluids are poured together, which will float?

When many fluids are mixed, — e.g., water, oil, air and quicksilver, — in what order will they come to rest? Why?

. . . .

When does a teakettle boil over? Why?

What results when you put your thumb on the bulb of a thermometer?

Why are spaces left between the ends of rails on a railroad?

Why does a smith heat a tire before putting it on a wheel?

Cork and heat a bottle of ice-water, and what results?

Cork tightly a thin test-tube of air, and heat it. Result?

Balance two dippers of the same size; fill one with hot and the other with ice water. Which is heavier?

Try the same with bottles of hot and cold air.

Tie a piece of thin rubber over the mouth of a bottle of cold air, and then heat it. Result?

What results to water, air, and iron, when heated?

Do you know of any other substances that expand when heated?

Which is heavier, bulk for bulk, hot or cold air? water?

Which will float upon the other, the hot or cold?

When you press a stick into the water, what lifts it to the surface?

Why does heated air rise? What lifts or floats it?

. . . .

Do we generally find the colder air near the ceiling, or floor, of a room?

Why is it warmer over a hot stove than under it?

What turns the little "windmill" over a hot stove?

In what direction do flames generally shoot? Why?

What causes the draught up a chimney?

Why do smoke and sparks rise?

What carries Santa Claus' letters up the chimney?

What causes a draught when we open a window on a cold day?

Why do soap-bubbles rise? Vapor from the breath and tea-kettle?

Which causes the better draught, a tall or short chimney?

Why does shaking the grate start the fire?

Where are ventilators placed in cars? Why?

How are mines sometimes ventilated by fires?

With what are balloons filled? What floats them?

How the Atmosphere is Heated. — Do we find the air warmer or cooler, as we ascend hills and mountains?

Why does it not become warmer as we approach the sun by climbing upward?

Why is the zinc on the wall behind a hot stove warmer than the air near it?

Hold a thermometer against a sunny sand bank, then one inch from it, one foot, three feet, ten feet; top of a tree. Where is it warmest? coldest?

Which is warmer, the air over a sand-bank or green field in sunshine?

How is the atmosphere heated?

If the air were heated directly by the sun, what would result?

Where would it then be warmest?

. . . .

Test the temperature of a pond and its sandy bank in sunshine, and again late at night. Result?

Which heats more slowly during the day, and which retains its heat longer after sundown?

Over which is the air lighter during the day? night?

When there is a difference in temperature between two places, what motion of the air results?

What, then, causes the land and sea breezes?

Which do you think have more even temperature, places near the ocean or inland?

. . . .

Why do we like to have it cloudy on hot days?

Does all the sun's heat reach the earth's surface?

Why does the air become cooler as it floats upward?

What becomes of its heat?

How high can heated air float? What stops it?

When will it come down?

How high can a balloon rise? a soap-bubble?

When must they come down? What brings them down?

When you sift flour over a lamp chimney, or throw bits of paper over a hot-air register, where will they settle?

Why do they not come directly down?

Why does not the smoke above a hot stove settle down upon it?

Where, then, will air come down after cooling?

In what direction must it move after coming to the surface?

Upon what does the speed of wind depend?

What names do you know for winds of different rates of speed?

From what direction do your warm winds blow? cold ones?

Which are oftener accompanied by rain?

Uses of Air. — Do fishes breathe?
What brings our rain-clouds?
What becomes of the breath we exhale?
What animals travel in the air?
Of what use is wind to sailors?
What machines are moved by air?
What makes waves?
What damage is caused by wind?
Have you ever been told what causes the twilights?
Of what use are gales?
Is air of greatest use in motion or at rest?
Name all the uses of air that you know.

NOTE. — Questions may also be added, if thought desirable, to lead the pupils to discover the simple laws of bodies in motion tending to maintain uniform motion, and also motion in straight lines, thus preparing for the influence of rotation in westing the trade-winds, and easting the return trades. But this may, perhaps, be better studied in connection with the advanced work.

4. FORM, SIZE AND MOTIONS OF THE EARTH.

Too strong a plea cannot be entered against the pernicious practice of plunging little children into the book-study of mathematical geography without any previous training in the observation of the heavens. One of the simplest and most fascinating parts of the whole subject is thus made the most abstruse. The very manner of presenting it by definitions becomes a barrier to future observation. What the mind once conceives to be complicated, it can never after approach in its simple beauty.

There is much in this line of work that the child can readily discover for himself, if the teacher will but direct his observation, and allow him time. Moreover, it affords an excellent opportunity to cultivate the habit of persistent observation of

the same object through a long period of time, and no one will deny the importance of this habit in every department of study and research.

For example, the question is asked in September, "At what time of the year does the sun shine the shortest distance into the schoolroom at noon?" The limit of its shadow is then marked on the floor, and each sunny day the children observe that the sun runs lower, and that its light reaches in farther and farther till finally, in the latter part of December, it remains nearly the same for a few days. The limit of its shadow is then carefully marked and preserved. At the same time, attention is called to the changes taking place in nature, — the wonderful phenomena of changing seasons. Then the path of light becomes shorter and shorter, and the children readily discover that the sun is rising higher in the sky. While it continues to shorten, we mark its limits once a week, putting the dates opposite their appropriate marks. Finally, in June, it reaches the same line, or moves apparently through the same path for a few successive days, and then begins its downward journey.

Thus all through the school year the children have noted the varying path of the sun, and the influence of its position upon the seasons. They have learned that autumn ends and winter begins when the sun travels in its lowest arch, and that spring ends and summer begins when it moves along its highest path in the sky. Its middle arch travelling northward opened the spring, while the same path in its southward journey marked the end of summer.

Later in the course, when the children need to study the division of the earth into zones, we may base the work on these observations and records. We may then tell them that the lines on the earth directly under the highest and lowest

paths of the sun are the tropics; and under the middle arch, the equator.

Finding the difference in direction between the lines of light from the extreme paths, will show then approximately the width of the torrid zone. A little reasoning will show that the light shines just as far beyond the north pole as the sun travels north of the equator, and *vice versa* for the south pole. Thus all the circles and zones may be taught in the advanced work by means of these elementary observations. When the pupils have added to all this the apparently fixed position of the north star, they have laid the basis for the study of the inclination of the earth's axis.

Many more facts may be drawn from this, but enough has been given to show how much lies in the path of simple observation. Considering the importance of such investigation, may we not justly conclude that this beautiful science should not begin with mere memory work of mystical circles, zones and motions, but with something full of interest and reality? Important lines of investigation are indicated by the following questions. As some of them must continue through whole seasons, *it is essential that the pupils record their observations in their note-books throughout entire seasons. These questions are to be answered by the children, and not by the teacher.*

The motions of a body can be discovered only by observing a change in position relative to at least two other bodies having different motions. If the earth and sun were the only heavenly bodies, man might still be ignorant of the earth's motions. He could, of course, discover motion, but would lack means of determining which moved, the sun or the earth. But by observing the motions of these two bodies relative to distant stars, and of the stars to each other, he

has discovered that the earth has several motions. This explains why questions about the moon and stars, as well as the sun, have been included in these elements which are to prepare for the higher study of mathematical geography.

Children should be led, as early as possible, to observe, not from the standpoint of appearance, but of *reality*. When their investigations warrant the comprehension of a simple explanation of rotation and revolution, is not that the proper time to make it, not a detailed description, but only such statements as will lead them to think of these two real motions?

Very full answers to these questions ought not to be expected from the pupils. Mere knowledge should be secondary in importance to the fact that the questions incite continued observation, and awaken interest in the subject.

Apparent Form and Size of the Earth. — How far away is the horizon?

Could you ever reach it by travelling westward?

What is the shape of the horizon on the water or on a plain?

Do the clouds touch the horizon? Why do they appear to?

What seems to be the shape of the sky?

How far can you see when you look upward?

Can you see as far along the surface of the earth?

Why must you climb high to see a great distance?

From what part of a ship can sailors first see land?

What part of a ship disappears last as she sails to sea?

Why are light-houses built high?

What is the shape of the earth's shadow on the moon during an eclipse?

Has any one ever found the edges of the earth?

If the earth were flat, upon what part would the sun shine when it first rises?

Could the sun then shine upon any part when it is night here?

Is the time of day the same all over the world? Reason?

If it were flat, and you did not live in exactly the centre, which would be longer, the forenoon or afternoon?

If it were flat, could all nations see the same or different stars?

In what direction do the sun and pole-star seem to move as we travel south for many days?

Who first sailed around the globe?

Do you know the story of "Copernicus and the Globe"?

Apparent Motions of the Sun. — What is the color of the sun?

Has it always the same color and shape?

How large does the sun seem to be?

At what time of day does it appear largest?

Where is the sun on a cloudy day?

Which is farther from us, the sun or moon? Prove it.

Which are farther away, the clouds or stars?

Who was Phœbus?

ROTATION.

Where is the sun at night?

Of what use is night?

What do we call the light just before sunrise?

Of what use are dawn and twilight?

Can you tell the story of Cinderella, and why the *prince of light* can never overtake the *dawn*?

Which is longer, day or night?

Are all days equally light, and all nights equally dark? Why?

When does day begin? night?

What is the meaning of A.M., P.M. and M.?

When is it evening? How long is noon?

What changes occur in nature during evening? morning?

Where does the sun seem to rise?

Does it always rise in the same place?

Does it always rise at the same time of day?

How often does the sun seem to travel around the earth?

In what direction?

If the sun does not move around the earth, how else may day and night be caused?

Can you feel or see the earth turning?

If the earth turns (or rotates) in what direction must its rotation take place? How often?

Do you know the story of Phaëton?

REVOLUTION.

Does the sun rise earlier in summer, or in winter?

When does it rise exactly in the east, and set in the west?

When does it rise farthest north? south?

When do we have longest days? nights?

When are day and night equal?

Is the sun always in the same place at noon?

Does it ever come directly overhead?

In what season do trees cast the longest shadow at noon?

When does the sun travel highest in the sky at noon?

When does it move in its lowest arch?

Where is the sun's path when we have longest days?

How long time does it require to make the change from the highest to the lowest arch?

What season begins when the sun is in its lowest path?

Is the sun now travelling toward its high or low arch?

Mark the limit of the sunlight on your schoolroom floor or wall at least one day each week at *noon*, and discover which way the sun seems to travel, when it is farthest north and south, when it seems to stop, change direction, and travel most swiftly.

What uses of the sun do the following words suggest? Day, summer, melt, dry, time-table, compass, dates, moon, fruit, eggs, force, scavenger, winds, rain, seed, tea, color, bleach, rainbow.

Apparent Motions of the Moon. — How often does the moon rise?

When does it rise?

In what direction does the moon seem to travel?

Does it always move in the same path?

Do the moon and sun rise in the same place?

When the moon is rising, could you not go to the horizon and touch it?

Which is longer, a day measured by the sun or moon?

When does the moon travel in its highest arch?

Which seems to travel faster, the sun or moon?

Does the moon always appear near the same stars?

In what direction does it seem to move among the stars?

Note its position near some bright star, and discover in how many days it will return to about the same spot at the same hour.

Where is the moon during the day?

Why are not all nights lighted by the moon?

What is the "harvest moon"?

Is there a man in the moon?

Do the spots on the moon ever seem to change?

How often do we have a new moon?

Draw all the shapes and positions of the moon you have seen.

Where is the sun when we have a full moon? new moon?

Are the ends of the crescent turned toward or from the sun?

Is the sun east or west from the moon when it is waxing? when waning?

Where is the sun when the moon is gibbous? crescent?

What part of the moon is always light?

What part of the earth is always light?

Where is the sun when we see an eclipse of the moon?

Where is the moon when we have an eclipse of the sun?

Did you ever see an eclipse of the moon in the daytime?

What are the uses of the moon?

Apparent Motions of the Stars, Planets etc.

FIXED AXIS.

What becomes of the stars when the sun rises?

Where is the pole-star?

Where is it in winter? summer?

Where is it when the sun seems to travel northward?

Where is it at night? early in the morning? at noon?

Does it seem to move? (Pupils cannot discover the gyratory motion of the earth.)

Put a stick in the ground, pointing to Polaris, and see if during any part of the year it moves out of line. (Although the axis of the earth will not point directly toward the North Star for about three hundred years, the stick set in the ground is approximately parallel to the earth's axis.)

In what seasons does the sun seem to approach the North Star day after day?

What use do sailors make of this star?

Could they not as well use any other? Why?

Have you heard the story of Callisto?

ROTATION.

Does Polaris rise and set?

Where is the Great Dipper (Ursa Major)?

Which of its stars are called "pointers"? Why?

Is the Great Dipper always in the same place?

In what direction does it seem to travel?

Does it move in the same direction as the other stars?

Does its handle ever point toward the North Star?

In what part of the Little Dipper (Ursa Minor) is the North Star?

Does the Little Dipper appear to move? In what direction?

Does either dipper ever dip below the horizon?

Do they ever vary in distance from Polaris?

Can you find the **W** (Cassiopeia) and the Pleiades?

Do they rise and set?

Who were Perseus and Andromeda?

REVOLUTION.

Is the Great Dipper in the same place every evening?

Can you see it every starlight evening?

Can you see the Northern Cross and the Pleiades every starlight evening?

In what season does the Little Dipper hang down from Polaris in the early evening?

In what season does the Great Dipper pass over Polaris in the early evening?

Which is longer, a day measured by the sun or by a star? How much? Time it.

In how long a time would this difference amount to a whole day?

. . . .

Can you find Vega (in Lyra) and Thuban (in Draco)? (These two stars should be indicated if the teacher wishes to explain in the advanced work the gyratory motion of the earth. Thuban may also enter later into the study of the history of Egypt, that having been the pole-star when the Pyramid of Cheops was built, about four thousand years ago. Vega will be the pole-star in about thirteen thousand years.)

How can you distinguish the planets from the stars?

Try to count the stars.

Where is the Milky Way? Is it always in the same place?

What is the color of Mars? Venus?

What do we mean by morning and evening stars?

Which is morning star now? evening star?

Do you know any stories or myths about the stars, clouds, moon, sun and earth?

What is a comet?

Does it rise and set like the stars?

Is its head or tail turned toward the sun?

What are meteors and shooting stars?

In what months do we generally see the greatest number of "shooting stars"?

Draw a star, a comet and a planet.

What are the uses of stars? planets?

5. CLIMATE.

Heat and Moisture. — Which is warmer, day or night? Why?

Is it generally warmer when the sun is rising or setting? Why?

Why does it become warmer as the sun rises higher?

Where is the sun during the hottest part of the day?

Why is it not hottest at midday?

At what time do we receive the most direct rays?

Which are warmer, long or short days?

Will a square yard of surface receive a greater quantity of vertical or oblique rays?

Which rays travel through more atmosphere?

Which would be more easily thrown off?

Which would strike with greater force?

What part of a ball, if held in the sunshine, would receive the most direct rays? the most slanting?

Where, then, is the hottest part of the earth? Where are the cold countries?

In what season are the rays most slanting at noon?

What changes take place in the seasons as the sun travels northward?

Which is colder, the forenoon or afternoon? Why?

Which is colder, spring or autumn? Why?

Which is the hottest month?

Where is the sun at that time?

How many months of warm weather do we have?

When are "dog-days"?

Why is it not the hottest part of the day when the sun is highest in the sky?

Why is it not the hottest part of the year when the sun moves in its highest arch?

Where is the sun during the coldest part of the year?

Is it coldest at midnight, or just before sunrise?

Why is it not the coldest month when the sun is in its lowest arch?

Where is the sun when each season opens?

South from us, are the sun's rays more direct or more slanting?

Is it warmer or colder there than here? Why?

Describe a winter day, summer, spring, autumn.

Which season do you like best? Why?

What are the sports of each season?

. . . .

Which side of a building or hill is warmest?

On which side of an east-and-west wall does the snow melt first?

Which side of an east-and-west mountain-range would be warmer?

Is it warmer at the top or bottom of a hill?

Why are mountains good summer-resorts?

Where, then, in warm countries might we find cold weather?

Can you think of one use of plateaus in hot countries?

Where might snow be found even with the sun overhead?

From what direction do our warm winds come? cold winds?

Is it generally warmer or cooler on a windy or a calm day?

. . . .

Is the air warmer or cooler after a rainstorm?

When do you like to have cloudy weather?

Did you ever see fog on a windy day? Did it last long?

Do people like to build houses in swampy places? Why?

When do you feel more active, on dark and misty or clear days?

Why do people go to the seashore in summer?

Of what uses are land and sea breezes?

Upon what does the temperature of a sea-breeze depend?

In what condition would wind come from a warm current of water?

When does water stagnate?

Which kind of country affords better drainage, high and hilly, or low and level?

Which is the most unhealthful part of your own town?

Make a daily record of the temperature at noon for a year, and find the average.

Record the rainy, cloudy and sunny days, and compare the numbers.

Set a tub or large pan out in each rainstorm, and measure the quantity of rainfall. Do the same in each snowstorm; and having found the inches of snowfall, melt a quantity, and estimate how many inches of water are equivalent.

Note the directions of the winds, and discover which prevail; also, which precede rain or snow storms, and hot or cold waves.

This personal observation and record, while occupying little, if any, of the regular school time, will prove of inestimable value in the advanced work. No true teacher will, of course, assign a certain number of these questions for each day's work, and expect the children to find the solutions in books. Not the mere answer, but the *effort to discover*, should be the aim. The answers are in nature, and there alone should the children read them. Let us make the same observations, keep the same records, and perform the same experiments, that we require of our little pupils; or as Froebel has directed, "Come, let us live with the children."

CHAPTER VII.

C.—LIFE.

It is a well-recognized fact that plants and animals are organized to correspond with their natural environments; i.e., in their requirements of food, shelter etc., they are perfectly adapted to the physical conditions of their habitats. Whether the form of life be a direct result of natural surroundings, or not, the fact of correspondence remains; and it is evident that, as the flora and fauna of every country are determined by immutable conditions, a knowledge of these simple laws is essential to the proper study of distribution.

1. PLANTS.

Every school should have a garden spot in which the children could work and study. But if we cannot go out into nature, we must bring nature into the schoolroom. Let us interest the children by being first interested ourselves. Give each child some work to do. One may plant grass-seed in wet cotton; a second grow flaxseed in a sponge; a third make a cup by digging out a sweet-potato, filling with water, and hanging in the sunshine; a fourth put a sweet-potato in a tumbler of water, and allow the beautiful vine that will soon shoot out to grow about the wall; another make a flower-pot from a common potato, being careful not to injure the "eyes," and plant in it a German ivy or a

small onion. One or two air-plants will also interest and instruct the children. A few vegetables should be sprouted in a dark cellar, and their sprouts compared with those grown in the sunlight.

Have the pupils make boxes about a foot square by six inches deep, filling some with loam, others with sand and clay. In each box plant, e.g., corn, beans, acorns, rice, cotton, wheat, coffee and oranges. Set one box in the sunshine, another in the shade; keep one wet, another dry; put one in a warm room, another in a cold one. Mark the spot where each kind of seed is placed, with date of planting. Now the race begins. Which plant will appear first? Mark its date, and watch for the next. Let the children make notes of all they observe, for language lessons. As soon as new names are needed, give them.

By this device, the pupils will discover that some plants grow best in sand, others in loam or clay; some in wet soil, others in moist; some in cool places, others in warm. They may also discover that grain-stalks growing in one kind of soil are larger and stronger than in another. Why? They may compare the color and strength of plants growing in light and dark places, in wet and dry soil etc. One fact discovered is worth a hundred told by the teacher. The power to discover is a constant source of pleasure to every one possessing it. Let us not destroy this means of happiness in the children by telling them what their own efforts may reveal with delight.

Thus they are led to observe that different kinds of vegetation are dependent upon the conditions of soil, moisture and heat. A basis is thereby laid for the intelligent study of distribution. Occasional visits should be made to greenhouses to see foreign plants. Encourage the children to make a

collection of as many staple products as possible, and procure pictures of others. Give language lessons upon their uses, and tell interesting facts relating to their growth.

Then lead the pupils to classify them according to their various uses, e.g.: food, *rice*, *wheat;* luxuries, *spices*, *tea;* clothing, *cotton*, *flax;* homes, *pine*, *bamboo;* fuel, *pine*, *oak;* medicines, *poppy*, *cinchona;* manufactures, *mahogany*, *maple*. Also classify according to parts used, e.g.: trunks, *ebony*, *walnut;* leaves, *tea*, *tobacco*; roots, *manioc*, *sassafras;* barks, *cork-oak*, *cinchona;* seeds, *rice*, *wheat;* saps, *maple*, *pine;* fruits, *orange*, *grape;* buds, *cloves*, *poppy*. Again, group them as plants that grow in hot, warm, temperate and cold countries; then in very wet, moist and dry climate. Study the important ones only, and thus prepare also for commerce. After the pupils have studied the relief and heating of the globe, with their effects upon drainage, they can locate the great natural garden-spots, and cover them with plant-life.

When reading or giving descriptions of plants, if the names of any places arise, try to give the pupils some idea of their true location; do not leave them floating. It is also important that pupils discover the means by which plants are dispersed, and the barriers to their dispersal in the variations of the surface. The following questions are intended to suggest lines of observation. They should, of course, be varied to suit different localities.

Relation to Soil, Moisture and Heat.—What plants grow in swamps? in sandy fields?

In what kind of soil are the best potatoes raised? wheat? corn?

Where do water-lilies grow? thistles?

What plants are often seen growing from ashes?

Where do cranberries grow? rice?

Why do farmers "hill" their corn?

How does nature loosen the soil each year?

What are weeds? Name three.

What does the expression, "The soil has run out," mean?

How do farmers "rest" the land?

On what part of a farm can the heaviest crop of grass be grown?

What soil produces the coarsest grass and corn-stalks?

Which house-plants require the richest soil?

Will corn grow better in loam or sand, if well watered?

What covers the outside of a corn-stalk? of bamboo?

. . . .

When is the best time to water out-door plants?

Which of your house-plants need the most water?

Sprinkle water upon the leaves, but not on the soil, then *vice versa;* which prevents withering?

Why does putting the ends of flower-stems in water keep the leaves and blossoms fresh?

Why not put the leaves and blossoms in the water?

Which plants sprout most quickly in water?

What brings food to the roots of plants?

When seeds grow in wet cotton, where do they get food?

Which plants best endure a drought?

What trees or plants have no leaves?

. . . .

What vegetables and fruits ripen in early summer?

What ones ripen in late autumn?

Which are often destroyed by early frost?

What is winter wheat? When is it sown?

Of what use is snow to plants?

Why have trees generally long roots?

How deep into the ground do they penetrate?

What plants grow better in the shade?

What ones die every autumn? Live all winter?

Which house-plants need most sunlight?

What seeds must be sown in early spring? Why?

What ones may be sown in late summer?

Name three plants that bloom in early spring.

What ones will yield two crops a year?

How long does it take potatoes to ripen from the seed?

In what season does sap flow into the trees?

Does it ever flow back?

What are evergreen trees?

How are the seeds of the pine protected?

What trees drop their leaves in autumn?

When do the leaves change color? fruits?

What trees are often injured by early spring weather followed by frost?

Why are many buds covered with pitch, and partly filled with woolly fibre?

Means of, and Barriers to, Dispersal. — What plants send out runners or shoots?

How far can such plants spread?

Can they cross rivers, meadows, mountains or deserts?

Of what use is the little tuft (pappus) in the dandelion blossom?

Draw a maple seed; an ash seed.

What animals scatter grain and nuts?

What birds feed upon seeds?

In what seasons do birds carry seeds farthest?

Name three common plants that will grow from slips.

What seeds are so light that they may be blown about?

Where do the seeds of the pine grow?

What seeds will float in water?

Where might such seeds be carried?

In what ways may seeds be scattered over a plain?

How may they be carried across rivers, mountains etc.?

Of what materials do birds build their nests?

What weeds are destroyed with greatest difficulty?

What harm is done by weeds?

Name an enemy of the potato, apple, tomato, wheat, grape.

What birds feed upon corn? rice? berries?

What plants can survive a long drought?

If a fruit requires a long, warm season for ripening, where can it not survive?

What kind of plants can grow in cold countries?

What prevents oranges, sugar-cane and pine-apples from growing in northern lands?

When were potatoes and tobacco first used in Europe?

From what country did we first obtain tomatoes?

Where was the first wheat brought from to this country?

Which of our common grains are not native here?

Uses of Plants. — What are the most important six food-plants?

What kinds of cloth are made from plants?

From what is linen made?

Name six important medicine plants.

What is tar? turpentine? oakum? jute?

What use is made of hemlock-bark?

What is tapioca, and how is it prepared?

How is India-rubber obtained?

Name six important cabinet woods.

What are the uses of bamboo? pine?

What articles are made from bark? sap? buds? leaves? blossoms? seeds? roots? osiers?

What plants supply valuable oils?

What common animals feed upon plants?

Of what use are leaves to the atmosphere?

What plants are used to flavor drinks?

Name four ornamental trees.

What animals would die if all the trees were cut down?

Groups for Special Lessons. — Rice, wheat, maize, rye, oats; pine, maple, teak, cork-oak, palms (oil, date, rattan), mahogany; cotton, flax, hemp, jute; sugar-cane, bamboo; tea, coffee, cocoa, tobacco; poppy, cinchona; orange, lemon, bread-fruit, yam; pepper, nutmeg, clove, cinnamon.

2. ANIMALS.

Food and Structure.—What do the following animals feed upon? Horse, sheep, hen, duck, rabbit, squirrel, bee, fly, butterfly, spider, mosquito, mouse, eagle, whale, bear, camel, deer, elephant, giraffe, lion, silkworm, monkey.

What use does the cat make of her claws?

Compare a cat's paw with a dog's.

How does a dog seize its prey?

What is the difference between a duck's bill and an eagle's beak?

How is each used?

Write a careful description of a duck's bill.

Why is the eagle's beak curved?

How do the feet of the hen and duck differ?

Can ducks roost? geese? pigeons?

Has a hen teeth? Has any bird?

Why do not the horse and cow bite (?) off grass in the same manner?

How does the spider capture its food? Draw a spider's web.

Where do long-legged birds generally live?

What birds have long necks?

Where do they obtain their food?

Why do some birds fly about in the night?

What do they feed upon?

Would a short neck be as useful to a giraffe as a long one?

What fish uses a gun? a line and bait?

Draw a woodpecker's foot and tongue.

Where do birds get their food in winter?

Why do some fly away? Where do they go?

What are birds of passage? Name three.

What animals feed upon grass? grains? fruits? flesh?

Where do sheep and goats like best to feed?

What animals chew the cud?

What enables the camel to travel so long a time without (?) water?

Of what use is the hump to the camel?

Why were our front teeth made sharper than our back ones?

What would result if the cat had hoofs, the horse wings and a beak, the mouse horns, the dog a bill, the woodpecker web-feet?

Ought not squirrels to have wings?

Why were not the feet of all animals made alike? the mouths?

Describe as many kinds of feet and mouths as you can, and tell their particular uses.

What animals get their food from the water? How?

How does an elephant drink? camel? hen? horse? dog? mosquito? man?

Covering and Climate. — Do clothes make or keep us warm?

What animals are covered with fur? feathers?

What covering has the lobster? oyster? snake? codfish? butterfly? frog? cat?

What do we call the hair on a sheep? beaver? pig?

Of what use is hair to animals?

Have all animals hair?

Of what use is the horse's tail and mane?

Why is a girl's hair longer than a boy's?

Which are warmer, feathers or furs?

Which are lighter? Which shed water more readily?

What are live geese feathers? What is down?

From what part of the ostrich are plumes taken?

Do "birds of a feather flock together"? Why?

Have all fishes one kind of covering?

Draw a fish-scale.

What animals live both on the land and in the water?

Would not scales make a better covering than fur for seals?

What animals need the warmest covering?

Where would you go to find good fur-bearing animals?

What animals shed their furs? Why? When?

What animals shed their skins?

When do birds moult? Why?

Do oxen sweat? dogs?

Do insects need warm coverings?

How are the feet and knees of the camel protected? the eyes and nostrils?

Compare the feet of the ostrich and camel.

Do animals in cold countries have dark or light coverings?

How is the whale protected from the icy waters?

Name all the kinds of coverings that animals have, and the particular use of each.

What animals sleep during the winter?

What birds remain with us during the winter?

Do animals migrate to escape cold weather, or to obtain food?

Where are the frogs and snakes during the winter?

Why do bees store honey?

What other animals store food for winter use?

Means of Defence. — How do the following animals defend themselves? Snake, cow, horse, dog, bee, crab, bear, deer, mouse, fly, goat, turtle, elephant, ostrich.

Of what use is color to animals?

What animals use poison?

Why is it difficult to catch young partridges?

What animals defend themselves by means of swords? saws? quills?

How does the squid elude its enemies?

Where do young alligators go as soon as hatched? Why?

What animals depend upon speed for safety?

What ones hide? change color? feign death?

What ones are tamed by hunger? by fear?

Why do beavers dam brooks?

What plan of escape have they from their houses?

How many eyes has the fly?

What animals have keen scent? sight? hearing?

Have fishes ears?

How do hens warn their chicks of danger?

How do they protect them?

What animals follow leaders? post sentinels?

How do little sparrows drive off large birds?

What fishes elude their pursuers by leaping into the air?

What bird defends itself by kicking?

What ones seek to escape by diving and swimming?

Why do sea-birds fly in the trough of the sea during gales?

What birds strike with their wings and spurs?

What animals have bony coverings?

Name an enemy of each of the following: hen, rabbit, robin, rat, cat, deer, elephant, fly, rattlesnake, lion, monkey.

Means of, and Barriers to, Dispersal. — In how many ways can birds travel from place to place?

What birds cannot fly?

What animals have no legs? How do they move about?

How might animals living near the sea be carried far from home?

What land animals can cross rivers?

What animals are often blown to great distances from home?

What ones cannot swim?

Are frogs ever found in salt-water?

What animals can live in cold countries only?

What ones live in deserts? forest? on mountains? in swamps?

Can clams and oysters move about?

Can fresh-water fish live in salt-water?

Why cannot a robin fly around the globe?

Will turtles, seals and frogs live if kept out of water a great length of time?

What birds feed upon grains? Can they live in very cold countries?

What do silkworms feed upon? Where only can they live?

What animals must live near bodies of water?

Where must each of the following make its home? Beaver, duck, squirrel, hen, deer, horse, fly, bee, camel, seal, eagle, mosquito.

What wild animals prey on sheep? deer? rabbits?

Can beavers and otters cross mountains and deserts?

Why cannot monkeys live in open plains?

What animals cannot live long in forests?

What ones would starve if set free in cold countries?

Why cannot the polar bear leave the cold regions?

What animals cannot cross broad valleys?

What ones can cross oceans? deserts?

When were the horse, cow, sheep and hen first brought to this country? By whom?

Uses of Animals. — What animals supply food to man? clothing? shelter? fuel? light? medicine?

What parts are used for each purpose?

What animals are employed as beasts of burden?

Which is more useful, the horse or the cow?

Does leather grow? How is it prepared?

What animals yield valuable skins?

What ones are kept as pets?

What are domestic animals? Name four.

Where is whalebone obtained? sperm oil?

What uses does man make of the cow? reindeer? hen? sheep? elephant? horse? dog? camel? rattlesnake? cat? whale?

What articles are made from skins? horns? hoofs? hair?

Groups for Special Lessons. — *Cat*, lion, tiger; *dog*, wolf, hyena; *horse*, zebra, quagga; *ox*, buffalo, bison, musk-ox, yak, zebu; *deer*, cashmere goat, elk, reindeer, eland, gnu, chamois; *hog*, tapir, hippopotamus, rhinoceros, elephant; *camel*, dromedary, llama, alpaca; various apes and monkeys; *ant-eater*, armadillo, echidna; *opossum*, kangaroo; *giraffe; alligator*, crocodile; *ornithorhynchus; beaver*, otter; *ostrich*, nandu, apteryx; *eagle*, condor; *goose*, swan, flamingo; *pheasant*, lyre-bird, bird-of-paradise; *boa*, python; *seal*, walrus; *whale; mackerel*, cod, salmon; *corals* and sponges.

It will be readily inferred that no scientific classification is attempted in the above list, but only a convenient order of study.

Pupils should learn at least the characteristics of each group, and become familiar with the species through pictures, stories, descriptions etc. The solar camera will be found an excellent device in the study of animals. The work may take the form of oral and written language lessons.

CHAPTER VIII.

D.—MAN.

1. *OCCUPATIONS.*

EVERY child may be led to see the necessity for work, by calling attention to the manner in which food and clothing are obtained and prepared. He will readily understand that we must build houses, obtain fuel, provide defence, and procure food; that we cannot keep good health without labor which earns us rest and sleep. He may also discover that a man's immediate surroundings often determine his occupation. The rich soil, the swift stream, the mine and quarry, the forest, the ocean, all suggest what labor he shall perform.

The principle of division of labor leading to the social life of man is everywhere illustrated: in the home, on the playground, on the farm, in the workshop, and in the relation of each occupation to all others. Its value may be clearly shown by trying to trace a foreign product back to its native soil, by even naming the variety of occupations that combine to bring it to our homes. We should be lost in the maze. In this elementary step, the child should study the work of the farm, shop, mine, forest, sea etc., and discover the simple relations of the kind of labor to the productions of the surrounding districts.

2. COMMERCE.

It is but a step from production to exchange, — a natural outgrowth of division of labor. The work under this head may centre in the study of means of transportation and routes of trade; e.g., the railroad, steamship, river, canal and caravan. The relative cost of carrying, the speed, safety etc. may be discussed in a simple manner. The grocery, and nearest city to which produce is taken to exchange for other commodities, may be studied as types of centres of trade. Discover to what the city owes its growth, what its natural and artificial advantages are, and the economy of using it as a medium of exchange. Study also the means of transportation to and from it, and what determines the route of each.

3. RACES.

The highest aim in the study of man should be to develop a love for our fellow-beings. If we would make a child narrow in his sympathies and beliefs, keep from him all knowledge of the modes of life and forms of worship of little children in other parts of the world.

If we would have our children grow up with an ever-broadening love for humanity, both at home and abroad, we should early lead them to think of self as belonging to a great brotherhood of families. They should be told that they have little friends living in cold countries, wearing only the skins of animals for clothing, feeding on the flesh and blubber of the seal, having few if any pretty playthings, no fruits nor vegetables, no pleasant schools, and where the sun is sometimes not seen for many weeks.

They should learn how these little children spend their long days and nights, what kind of home they dwell in,

how they are kept warm, how their parents obtain food and clothing, — in short, how the lives of their little Esquimau friends differ from their own. To know and to think of these little people is to learn to love them; for the pretty flower "forget-me-not" symbolizes one of the most beautiful conditions in the culture of the feelings.

Pupils should be taught to share their gifts and pretty playthings, first with their poorer playmates, and then when possible with little people of other countries; to send boxes of useful and pretty things *made by themselves* to the Indian children, or even across the sea to mission schools. During the spring and summer, they may gather flowers for the hospitals and city schools, and in the autumn send fruits to some society caring for the poor children of a neighboring city.

Children delight most to study such people as the Esquimaux, Hottentots and Fuegans who show but little progress above the lower animals. They can easily picture the life of the savage in its details, and can even reproduce the plain hut and rude weapons. There is a bond of sympathy between the primitive race and the little child, for one is but the reflection of the simple life of the other. Barbarism is the childhood of enlightenment, and the savage is the child-man.

And so our children, by means of pictures and stories, should visit the homes of all classes, — should frolic with the "water-babies," play in the sand with the "child of the desert," swing in the deep wooden cradle with the "Lapland baby," spin along the ice-fields with the little "Arctic girl," learn to make and use the bow and arrow or blow-gun with the "Indian boy." Stories, pictures, specimens, and other materials should be used to make every thing as real as possible.

The pupils may then be led to compare the various races as to form, size, features, color, hair etc., and thus be prepared to distribute them (in the advanced work), by more than mere names, over the globe.

4. RELIGIONS.

This may be made one of the most interesting and instructive subjects in the whole course. What child does not delight to hear repeated the beautiful myths of Cinderella the dawn-maiden, Jack and Gill carried away by the moon, or Thor with his wonderful hammer, and to learn in how many forms these stories have been told to little children of other lands? And as they advance in years, with what interest they read of the voyage of the Argonauts, the adventures of Ulysses after the siege of Troy, the founding of Rome, and other stories which clearly indicate the beliefs of the ancient Greeks and Romans! Then the very mystery of the Magi fascinates, as they listen to the incantations around the sacred fires on the hilltops of Persia. How strange to them appear the awful tortures to which the one-sided religion of the Brahmins led! but how they learn to admire the noble young prince Buddha, denying himself every pleasure to live in the solitude of his cave, that he might discover the truth and help his fellow-beings.

By means of such stories, we not only excite great interest in the study of ancient peoples, and so cultivate a taste for historical reading and books of travel, but also lay the basis for the later study of the principal religions.

The work should be very elementary, and may take the form of stories. When the little folks are weary, or when the teacher feels a little "cross," just stop and relate one of these beautiful myths, or describe some queer customs,

and let the sunshine of interest into the schoolroom. How important it is that all teachers should be good story-tellers! and no subject affords better opportunity to develop this power than stories of the ancient gods and heroes.

When pupils enter the higher grades, they should continue the same line of work, till they are ready to study the distribution of religions over the globe.

5. GOVERNMENTS.

No society can exist without government, whether it be on the ball-field, the croquet-ground, in the home, school, workshop or state; and in each of these associations, we may easily discern, not only all the departments essential to good government, but also the various types or forms. It is an excellent practice to lead pupils to analyze their games, to discover who makes the rules, who decides questions of dispute, and who executes judgments; also to trace these departments through the home, school etc.

The study of special types may then follow, beginning with the simplest recognized form, the tribal, and considering successively the absolute and constitutional monarchies, and the republic. The principal aim should be to secure interest in the study, and then teach the essentials of the different forms. Pupils should also learn in what manner their town or city officials are elected or appointed, and what authority they exercise.

SUMMARY.

We have now reached the stage toward which all our previous work has tended. All that has gone before has been in preparation for the step beyond the limits of sense-perception into the realm of pure imagination. The apparent size,

form and motions of the earth are now to be resolved into a vast globe, rotating and revolving in the solar system. From the hills and valleys of our district, we are to build in imagination the great plateaus and river-basins of the globe. Our little brook, with its load of rich silt, has already shown us how the earth's great garden-spots have been made. The same laws that moved the air in our schoolroom, and over our little pond and sandy field, are now to girdle the globe with its great wind-belts. Obeying the same laws that have regulated the growth of the plants in our little garden or boxes, the surface is to be clothed with vegetation.

Then we are to see strange people, — not strangers either, for have we not already visited the homes of all classes? But now we are to study them, not as individuals, but in great *races* and *nations*. Wonderful will be our journey, but the amount of profit and pleasure we shall derive from it will depend largely upon the thoroughness of the study of our district; for only as we have acquired elementary ideas of geographical forms, forces and conditions, shall we be enabled to imagine them on the grander scale on which our beautiful planet is constructed.

PART II.

FOREIGN GEOGRAPHY.

CHAPTER IX.

GLOBE OR CONTINENT—WHICH FIRST?

WITH our present limited knowledge of the laws which govern the elevation and depression of great land masses, whether such action results from unequal radial contraction, flexions of an outer crust, lateral crushing and folding of an outer to fit an inner cooling mass, weakening of a crust by sedimentary deposits and consequent yielding to horizontal pressure, or from any other causes yet to be discovered, no teacher would be justified in the attempt to lead pupils to study the relief through any or all of these theories. In the light of present scientific knowledge, the relief of the continents must be *told* as fact; and the ability of pupils to imagine these unseen forms must depend primarily upon the association of words, models or other signs with the concepts of the corresponding forms in their district.

At the very outset many roads open before us. One leads from our immediate surroundings to our town, and then, in an ever-widening circle, to our county, state, country, continent and globe; a second, from our district to the continents,

and thence, after studying the globe, back to our country, state etc.; a third, from our district directly to the globe, thence to the continents, countries etc. The first of these plans, which is an outgrowth of a system that leads pupils to view the earth's surface merely as a succession of political divisions, must surely give way to a more rational system, based upon the study of natural divisions of the surface. Where the study of geography consists in merely memorizing political boundaries, capitals, exports and imports, races of men etc., the circle plan may answer its purpose fairly well; but with the introduction of *natural* geography must arise a new course of study, based upon the natural regions to be studied, and *where* must make room for *why*.

Thus, if we would know *why* a certain section or state yields cotton, sugar-cane or grain, we must first know not only the length of its warm season and the prevailing winds, but also its position within its continent, the general relief of that continent, and its position relative to the others, in order that we may judge its rainfall, climate and soil. Only by the study of the relations of the great features of relief to the winds and waters of the globe, can we reason to the life of a continent, country or state; therefore any system which leads from the district on the circle plan must necessitate *telling* rather than *teaching*, or leading to reason. No state or country owes its vegetable or animal life to its own structure alone, but to the relation of its surface to the whole globe in position and relief.

The question is therefore narrowed to this: In going out from our district, shall we study the *globe or the continent first?*

We are apt to be misled by the principle that "We must study from wholes to parts." Teachers often reason as fol-

lows: "The globe is the whole, therefore study it first, and afterwards the continents, countries etc." The error lies in the misconception of the meaning of unity. An apple is as truly a whole as the tree upon which it grew; a hill is a whole, yet in the analysis of a landscape, we should consider hills as parts; river-basins are wholes, although many of them may constitute a continent; likewise a continent or a globe is a whole, although continents are but parts of a globe, and globes are but parts of a universe. In short, any thing held in consciousness for analysis is a whole. There is, then, in this principle, no reason for teaching either the globe or continent first.

On the other hand, the argument is often used, that the mind can apprehend a whole only by a process of synthetizing; i.e., that a person must perceive the parts before he can conceive the whole. From this, one class advocate the teaching of circle geography; and another, the study of isolated continents, to enable pupils the more readily to imagine the globe. Let us look a little farther in the same direction. The surface of a continent is composed of river-basins; therefore, to be consistent, we must study each of these before studying the whole continent. It consists likewise of plateaus, mountains, ranges, valleys, slopes etc.; and if such reasoning be true, we should study the forms and arrangements of all these parts before trying to grasp the general relief of the whole. The argument thus dissolves in infinity. The error is in failing to distinguish between the conscious and unconscious mental processes. True, the mind synthetizes in cognizing wholes; but the first process of synthesis is an unconscious one, and should remain so until the whole as such is firmly fixed in mind. Then, and not till then, should the child be made conscious of the parts.

The application of this principle has given rise to the "word" and "sentence" methods of teaching reading. The former considers the idea as the unit, and teaches its corresponding sign, the word; while the latter regards the thought as the important whole, and so presents the entire sentence, — leaving to the natural action of the child's mind the unconscious synthetizing, in the former, of the letters in the word, and in the latter, of the words in the sentence. As soon as the wholes are firmly fixed, the phonetic drill, and conscious analysis into letters and words are consistently begun.

The same principle underlies the device of training pupils to count by threes and fours, i.e., to judge a number at a glance, without stopping to count consciously by ones. Far from supporting the practice of teaching the continents as a preparation for the globe study, it directly opposes it.

And yet, before a child can distinctly *imagine* a new whole, he must have gained clear concepts of the elementary forms which constitute that whole. But the study of these elementary forms in the various relations in which they appear as parts of the whole is not essential, nor does it aid in the imagination of the whole; in fact, as has been already stated, such study, before the whole has been firmly fixed, tends to prevent the mind from grasping the unity which should become the basis of analysis of relations later.

For example, the land surface is made of slopes, gradual and abrupt, long and short, some limiting hill forms or elevations, others valley forms or depressions. All differences in relief between the globe, continents, plateaus and river-basins, result from the arrangement of slopes; and when the pupils have clear concepts of the various kinds and relations of slopes in their district, and have associated

with each concept its appropriate name or sign, they are then prepared to be led to imagine any whole composed of similar slopes, whether it be a river-basin, continent or globe, with a clearness proportionate to the simplicity or complexity of arrangement of slopes in the various wholes.

The fact that certain slopes of the globe are so related as to form what are termed "continents," does not necessitate any study of these individual land masses previously to studying the globe as a whole, any more than the fact that certain slopes within a continent form river-basins renders necessary the study of these isolated basins in preparation for lessons on the continents. *Slopes*, not continents, *are the units of relief of the globe as well as of its parts.* The order of study ought, therefore, to correspond with the order of simplicity in arrangement of slopes.

In home geography the question, "With which form shall we begin?" was not of such moment, as all the wholes in the district study were wholes of perception. But in the advanced or continent work, as we are to study and analyze wholes of imagination, it is of the utmost importance that we begin with that whole which is simplest; i.e., in which the parts we wish to study are most simply related. Accurate analysis of an unseen form necessitates bringing it vividly into consciousness by the aid of the imagination.

We should also keep in mind that when an object is presented for study, we should lead the pupils to observe such facts *only* concerning it as will lay the basis for future study. From the quarries of nature we select the stones with which we are to build. True, we may often reject the "keystone;" but that is due rather to our narrow ideal than to a wrong principle. Thus the first study of the globe or a continent

should include such features and relations only as are essential to a higher step.

Before going out, then, from our district to study the unseen, or before going from wholes of perception to a whole of imagination, we must satisfy ourselves as to which of the two forms, the globe or the continent, is simplest in general relief, and which contains the relations of form and force which we wish to study as a basis for building higher. To do this we must examine both forms. The whole question hinges on how much of detail must enter into the study. In both cases we will limit ourselves to the features of relief which, when related to the winds, determine the general rainfall, — the first step beyond the study of relief.

As we have already observed, the great globe water-parting, or line of plateaus from Cape Horn to Cape of Good Hope, is so placed across the wind-belts as to admit the moist winds to the great slopes of the world; and it is only by the study of the relation of the whole of this great and continuous highland to the zones of winds, that we can determine the general rainfall and drainage, not only of the whole globe, but also of each continent. Thus the study of the general rainfall of Africa necessitates a knowledge on the part of the pupil of the influence of the great desert plateaus of Asia upon the trade-winds of the Indian Ocean, turning them into monsoons, enabling the plateau-continent of Africa, with its great tracts of heated surface, to cause the winds of the Atlantic to turn back upon their course and flow in upon its great slopes. Again, the rainfall of Europe can be studied only in the light of the influence of the location of Central America and Mexico upon the direction of the Gulf Stream, and also its position relative to the heated plateau of Africa.

The general rainfall, therefore, of every continent, while apparently directly determined by the position of its own primary highland, is very greatly modified by its position in the whole land mass of the globe. In fact, this is one of the elements of unity in the globe relief, that each part influences the rainfall, and through it the life of all parts of the globe. Rainfall cannot, therefore, be studied as the result of the relation of a continent or isolated portion of the globe water-parting to the moist wind-belts, but only from the standpoint of unity of the globe structure.

Moreover, in determining the *amount* of general rainfall, the secondary highlands play but a small part. As we have already observed, they enter the continent relief to individualize these land masses by localizing rainfall, gathering the water into basins, and giving special direction to drainage. Their value depends, therefore, almost wholly upon the position of the primary highlands, which may either admit to or shut off from them their water supply.

The place, then, that secondary highlands should occupy in a system or course of study is in that part which treats of the division of continents into river-basins, and does not belong to the study of the general globe relief in its relation to the general distribution of rainfall. But when we limit continent study to a single great water-parting, with a long and short slope, we merely teach the globe relief in five sections, which cannot be related until the globe is made the basis of relative position, and then only by conscious synthetizing of parts.

While the globe study needs therefore include the position and continuity of the great horseshoe plateau only, with its long slope stretching away on all sides to the Atlantic valley, and its short one descending to the Pacific, the conti-

nent study, while neglecting the important factor of unity, or, at most, striving to attain it through a process of conscious synthetizing directly at variance with the natural mode of action of the mind in apprehending relations, would also involve the study of secondary highlands and river-basins — details of relief which are not essential to the consideration of the general rainfall.

Continents ought therefore to be studied as *parts* of the globe structure, and should follow the study of the earth's surface in its unity, first, because the globe is the *simplest* whole, and second, because the globe study alone can lead to those relations to heat, winds and rainfall which enable the pupil to take the next step in the science.

When forms are to be studied as parts of a whole, their relative positions can be learned from the whole itself only, for in their relations they constitute the whole. These relations can be more readily discovered by the study of the whole before the mind is conscious of the parts. The great error, it appears, has been in burying the essentials of globe study in a mass of details that belong to the later work with continents and river-basins. It is, moreover, difficult to understand how the continents can be related successively to each other in the order studied, unless the globe is first made the basis of the relative positions. It should be remembered that by the study of the globe is meant here, not the study of the mathematical globe, but the relief, — not motions, circles, latitude and longitude, but merely the arrangement of great slopes.

The order of study, it would seem, ought therefore to lead from the district directly to the globe, and thence to the continents, countries, states etc., in their various relations to the whole.

CHAPTER X.

SAND MODELLING IN FOREIGN GEOGRAPHY.

IN elementary geography, the moulding sand is used as a device for securing attention to visible forms in nature. In foreign geography, it is used as a language or means of recalling concepts of land and water forms in the new relations in which they appear as continents. In the former it stimulates perception; in the latter, imagination. Moreover, the act of modelling or making the continents by the pupils is the best possible means of riveting the attention to the relations of slopes which determine the life of these great land-masses.

The criticism is often made against the use of modelling, that it pictures the continents to the child as mere heaps of sand, — lifeless masses. Far from being a just criticism of this helpful device, it merely shows that those who thus criticise fail to discriminate the real form from its language. Does the word "horse" printed in pica type recall a black oblong animal about half an inch in length, and a sixteenth of an inch in height? Neither does the moulded form distort or mislead: for used, not in the place of nature, but as the language of that which is beautiful and grand in our district, the models stand forth the very incarnation in imagination of the forms and life of the unseen world. Words in themselves are dead till backed by living and breathing thoughts: they then become

the embodiment of life. Symbols are at best but arbitrary signs; and the most perfect are those which, like sand models, suggest the concrete by their forms.

Before condemning the device, a teacher should consider carefully these questions: Are the little moulded forms used as symbols of greater forms in nature? Do they *recall* actual forms of land and water? Are we trying to lead the pupils to imagine the continents *in* the sand or *through* it? Are they studying mere signs, or are they viewing the reality beyond? Are we making a study of the glass in the telescope, or are we using it as a means of looking far out into the universe? Are we using the sand to teach *new* forms in different parts of the world, or merely to show the relative positions of features already known in nature, and which no symbol can distort?

And yet the claim is justly made, that the final mental pictures of the continents are diminutive, and that the proportion of altitude to horizontal extension is exaggerated. No statement can be truer, but it serves merely to indicate a lack of thought on the part of those who offer this as an objection to the device. Are they not aware that it is not within the power of mortals to grasp a stretch of three thousand miles, and place on it a slope one thousand miles long, and only eight hundred feet in its greatest elevation; that neither sight nor touch could detect such a slope if a reduced scale could bring the limitations of the continent within the range of vision, and yet preserve the true relation of height to breadth; that there never has been, and never can be, a map, picture or model made that will make perceptible to either sight or touch, even the true general form of the surface of a continent; that such a picture can never be even imagined in true proportion?

Although it is no argument, it may be suggestive to remind those who still hold to such an objection, that they are daily using maps which present the continents as having *no slope* whatever, save the abrupt sides of mountains which are printed or drawn many hundred times too large to be in true proportion; or even if they use shaded maps to picture the relief, the exaggeration is often thousand-fold. This reminds one quite forcibly of the "gnat and camel" metaphor.

Every representation of a continent must be constructed on a double scale, one for elevation and another for horizontal extension, as a necessary condition of perception and imagination. A form whose limitations may be included in a single act of perception may be readily recalled in true proportion; but a surface so extended that its whole may be comprehended only by a series of acts of perception of its various parts can never be imagined in its full extension. To come into consciousness as a single mental state, it must be contracted or diminished by the imagination.

By the same power we may also reduce a form whose limitations may be included in a single act of perception, and if the ratio of its relief to its extent is not too great, we may model, draw, or otherwise represent it to the sense of touch or sight in true proportion. But when the scale of reduction of the area is so great that to apply the same to the upraised forms would so diminish them that they could no longer be perceived by either sense, we must adopt the double scale of representation.

These are the conditions under which we must represent continents so as to enable the imagination to make a single picture of surface slopes in their relations of position. To illustrate: if it is desired to make a map of a township six miles square, containing a hill a quarter of a mile in height,

we may represent all upon a scale of one inch to a mile, making the town six inches square, and the hill one-quarter of an inch in height. This would preserve the proportions to both sight and touch.

But when we try to represent North America with its highlands upon a school map, e.g., four by five feet, we must, in order to bring the coasts within that size, use a scale of at least a thousand miles to a foot. Then the great western plateau that determines the general slope of the continent will be represented as a thousandth part of a foot in height, less than the thickness of a grain of sand or a pencil-mark. At the same time, the height of land dividing the great slopes of the Mississippi and Mackenzie basins will reach an elevation of only one six-hundredth of an inch. On a map of this size, therefore, even the highest plateau could not be drawn or moulded so that the most delicate sight or touch could reveal its slopes.

In making a relief map of North America *fifty feet* in length, on the school lawn, a scale of one foot to a hundred miles was used. Had the same scale been employed in making the elevations, the highest mountain-peak would have reached an altitude of only two-fifths of an inch, while the important height of land would have risen less than one-fiftieth of an inch to drain the slopes. The question, then, of using a single or double scale, in mapping a continent by either modelling or drawing, is one the original "Hobson" would have been delighted to solve, as there is but a single choice.

The query then becomes, "How much must the two scales differ?" The answer may be found above. The vertical scale must so far exceed the horizontal that the important features of the continent, viz., the table-lands and slopes,

may be easily perceived by touch and sight. Moreover, the slopes must be so distinctly outlined as to show clearly the drainage, or arrangement by which the waters are gathered into basins, and returned to the sea. As the *general* form and slope only are necessary to the study of drainage, and as the moulding is merely a *language* of form, it may be well to allow quite a little freedom in the use of the scale of elevation, turning the child's attention rather to the relative position of slopes.

The question sometimes arises, "Why not describe the surface by words, in the place of modelling or drawing?" We have already seen that modelling is the most natural language of form, and that a model will bring into consciousness the form which it symbolizes much more readily and distinctly than will a word. Moreover, a verbal description presents but a small part at a time, and the mental effort is thus divided between recalling concepts in succession, retaining them in consciousness, and finally relating them as they appear in the whole, — a process of synthetizing that few mature minds could ever hope to accomplish, even after great effort and long training. But the moulded or shaded map presents the continent as a whole, in which the relations of parts may be readily perceived.

The map in actual relief has a great advantage over the shaded one, in that the former may be made to appeal to both sight and touch, while the latter can only be perceived by the acquired form-sense of sight. The relief, therefore, gives far more accurate knowledge, and greatly shortens the time necessary to fix it in memory.

"But," continues the querist, "are not the forms modelled by the pupils very imperfect, and might not the time be more profitably spent in seeing and feeling the surface of a cast as

perfect as could be obtained?" Most assuredly the first map made by a child is very imperfect if compared with the finished cast, but it is an approximately perfect reproduction of the form in his mind. It is not a wrong form to the child, for his expression merely symbolizes his own concept; and the attempt to reproduce incites to repeated acts of observation of the accurate cast, thus enabling him to correct or rather improve his ideal. Here we see again the necessity of always having a model before the class for comparison. This form of expression also affords the teacher a golden opportunity to look into and examine the condition and mode of action of each mind.

In reply to the second part of the question, it cannot be gainsaid that no child or mature person can study a form by merely touching it a great length of time without strong stimulus, or great effort of will. This, however, may be readily obviated by the requirement to model it.

While thus advocating the use of the sand as a means of teaching the slopes of the great land-masses, there is no intention of claiming for it an importance greater than attaches to many other devices. Sketching, shading, painting, reading, describing etc. ought not to be neglected. Each has its appropriate work to perform, and power to develop, and will receive mention in its proper place in the system.

CHAPTER XI.

A.—RELIEF.

1. THE GLOBE.

Form and Size.—After the pupils have made the observations called for by the elementary questions, it will require no telling to convince them that the earth is round, and of immense size. Long before this time they will have reached these conclusions. They cannot, however, measure different arcs upon a meridian, and discover that the earth is not a perfect ball; neither can they determine the difference of zenith distance between two stations, and by triangulation compute the earth's dimensions from the measurement of a degree of circumference. They must be told the real form and size, when such facts are required. It is true that by the swinging cylinder and the gyroscope, we may illustrate that a body tends to revolve about the shortest axis of its figure, and persist in the plane of its rotation; but the application of such laws to confirm the explanation of the earth's spheroidal form does not come within the scope of this work. The earth's form may be illustrated, but not explained, by the familiar device of the tin hoop, or large hollow rubber ball twirled upon its axis.

We should avoid confusing pupils by mere theories. If given at all, they should be regarded as the bare opinions of individuals, which as yet stand unproven. *Experiments should tend rather to illustrate laws of nature than to support*

theories. Thus, centrifugal force, or rather Newton's "first law of motion," may be illustrated by mud flying from a cart-wheel, a stone from a sling, the breaking of fly-wheels etc.; but these may or may not obey the same law that made the earth an oblate spheroid. Notwithstanding Newton has demonstrated that a plastic globe, rotating like the earth, would assume its exact form, it still remains to be proven that our planet was ever in a semi-fluid state. No good can come from belief in such theories. Better doubt all that lies buried in mystery, and thus keep the mind active in investigation. "Doubt," not belief, "is the beginning of wisdom," says Ritter.

The study of the motions of the earth in detail is not essential to the study of relief, and ought, therefore, to be deferred till the relief of the globe and continents has been studied. Moreover, the latter work will greatly develop the imagination, and thus prepare the pupils for the more difficult study of the motions.

In the district study, we have led them to think of the earth as rotating, and they have observed that the North Star seems to be in the axis of the motion. We may now, if indeed it has not already been done, give the name North Pole to the spot on earth directly (?) under Polaris, and South Pole to its opposite. They have also observed the varying path of the sun during the different seasons, and the lines on earth directly under its highest, lowest and middle arches may be named tropics and equator. Although not essential, these lines will be of service in locating the globe water-parting.

With these simple instructions as to the form and size of the earth, the poles, equator, and tropics, which need occupy not more than two lessons, we may turn directly to the study of relief.

Unity of the Globe. — Pupils are ready to study the relief of foreign lands when they have learned to *read* moulded forms and maps; i.e., when the little models in sand, and the characters used upon maps, have been associated with their corresponding concepts of land and water forms. The power to imagine the great unseen features has been gradually developed in the district study (see p. 67).

One manner of beginning this work is to present to the class an ordinary globe on which the great line of plateaus, from Cape Horn to the Cape of Good Hope, together with the long slope toward the Atlantic and the short one toward the Pacific, have been modelled in putty. To make this representation more complete, the teacher pictures the earth surrounded by its atmosphere bearing the clouds, also with its broad valleys partly filled by the oceans, its great slopes, table-lands, etc. This is to turn the attention from the sign to the reality, lest any study mere symbols.

The pupils may then be led by questions, and by attempting to model the same general form upon small globes or croquet-balls, to *discover* that the great plateau extends almost around the earth in the shape of a loop or horseshoe, the ends approaching each other in the South Atlantic; that the slopes within the loop are much longer than those without; that all the long slopes encircle the same ocean; that the ocean on the side of the short slope is much the larger; that there is about three times as much water as land; that the oceans extend into the land in places, and almost cut off large parts of this highland; that in one place they cut completely through; that these parts or land-masses (the name "continent" should be given) are not equal in extent; that each continent contains a portion of the globe plateau; that each is a section of the long and short slopes of the

globe. They may then study the position of the great line of plateaus, as determined by the poles and equator; the direction of each land-mass from the others, and the position of each continent and ocean in the globe relief.

The teacher should direct the observations by judicious questioning, but the pupils should discover the facts by their own efforts. Modelling the globe surface as outlined above is an excellent device for riveting the attention on slopes, and fixing the facts in memory. Simple oral and written descriptions should also be required. Pictures of portions of the plateaus, slopes and oceans should be shown the pupils, and used in language lessons to aid them to imagine vividly. We should gladly accept any other facts discovered by the children; but the rule should be to spend no time upon unimportant details, or upon such as can be studied to better advantage later, at a time when they are essential to higher generalizations.

This globe work should be very simple, and as soon as the pupils have a fair knowledge of the general relief and relative positions, the work with the separate continents should be begun. Little, if any, attention should be paid to mathematical geography at this stage of the work.

2. THE CONTINENTS.

The greatest fault in all geography work is the attempt to teach too many details of relief, outline and location. How often are our little children forced to model and draw hundreds of unimportant forms of relief and coast-line which the teachers themselves cannot retain in memory, and which they consider worthless in their own education! and all this merely because they are in the book, and may be called for in an examination.

The overworked minds and broken constitutions among school-children result not so much from *too many* studies as from *too much* study of worse than worthless details. In no subject, with the possible exceptions of arithmetic and history, is this terrible fault more glaring than in geography; nor will the proper remedy be found till such teachers, having a higher aim than to prepare for a superintendent's examination, realize that they are in a great degree morally responsible for the sad ruin caused by overwork. Is it not equivalent to holding position and building reputation at the expense of the health and mental growth of little children, depriving them of the time and opportunity to develop their minds and bodies, and store up useful knowledge?

In deciding what features of relief and outline to teach, may we not find a safe guide in this principle? *Teach such forms and facts only as are essential to taking the next step in the science*, omitting the mass of details that bury the important features and serve merely to crush mental activity.

Modelling and drawing should go hand in hand, the former being the best of all devices for leading pupils to study surface slope, the latter to study coast-lines or lines along which the slopes extend under the sea. *All relief study should lead to the relative positions of slopes, — the basis of drainage.* The placing of mountain-ranges, lakes and rivers is of but little value compared with locating the great plateaus, tracing the principal water-partings, following slopes down to the river-beds and thence to the sea. Supplement the modelling and drawing at every step by reading, picture-study, stories etc.

Each continent should at first be considered as a portion of the globe relief with its long and short slopes. Its position and area *relative* to the others and to the oceans should

also be studied. Then the direct study begins by placing lesser plateaus (mountains are of minor importance) on the long slope, making the slopes from the primary and secondary highlands meet along the lines which locate the beds of the principal rivers. As has been already stated, the study of direction of slopes is of greatest importance. Compared with it, the mere location of isolated features or places sinks into insignificance. When the principal continental slopes have been grouped as river-basins, the *great mountain-ranges that serve as chief water-partings to the basins* may next be located. Give and use the names of important general features only. Concentrate the study on *form*, rather than on *names*.

It is well to avoid teaching a great number of features, lest the important ones be lost in the confused mass. Water-parting ranges have been selected because of their influence upon rainfall and the direction of drainage. Pupils should, of course, know that certain plateaus are crossed by many lesser ranges, but should enter into no detailed study of them.

Require the pupils to learn the heights of but very few highlands, only the average heights of the great plateaus, which as a rule may be doubled for mountain-ranges, and which generally increase in elevation toward the tropics for at least one obvious reason of causing rainfall. *When the average heights of water-partings or table-lands in one continent have been studied, those of the other land-masses should be learned by comparison.* Memorizing actual heights of mountain-peaks is clogging the mind with trash which, fortunately, it is able to throw off as soon as its possessor leaves school. Such study belongs to the geologist and meteorologist, but not to young students of geography.

Lengths, breadths and areas should be treated in the same general way, i.e., memorizing the average length, breadth and total area of *one* continent, and learning the others by comparison. These facts are sufficient to enable pupils to judge approximately the dimensions and areas of great plateaus and river-basins when such knowledge is required. Let the pupils study *comparative* elevations of plateaus, *comparative* areas of continents, *comparative* sizes of river-basins, *comparative* lengths of rivers, and all by actual *comparison.*

Knowledge of the exact number of square miles in the various river-basins, countries or even continents is not worth remembering. What, then, shall be said of the actual heights of mountain-peaks, lengths of rivers, areas of states, populations of cities etc.? We venture to say that the teacher does not live who, although he may have seen them fifty times a year for fifty years, is able or has any desire to be able to repeat from memory a tenth part of the follies of fact and figure which are ordinarily thrown into the child's mind as if it were some old attic to receive all this rubbish which disgraces the name of knowledge.

The study of slopes should lead us down to the sea, and just here the outline sketching begins. Coast-lines mark the height to which water rises on the slopes of the great valleys of the earth. They thus serve to indicate where and to what extent the sea enters the land-masses to supply moisture, equalize temperature, facilitate commerce, promote civilization etc. In determining how far we should enter into the study of details, we should be guided by the use we are to make of the knowledge gained. A safe rule is to *teach at first such indentations and projections only as exert a marked influence over the climate of a large portion of a continent.* Others may be added when required.

For example, in North America, in addition to the general directions of the coasts, we should teach the Gulf of Mexico, because it supplies rain to the Mississippi Valley and Mexico; Hudson's Bay, on account of its influence over the climate of British America; Florida, because it modifies the speed and direction of the Gulf Stream, an important factor in the climate of Europe. But to teach the scores of little bays and windings of coast-lines, within or around the greater forms, seems not only a great waste of time and energy, but also an absolute injury to the pupils. Such study of details at first thwarts the very object of the lesson, by preventing the mind from comprehending the important general outline or relative directions of ocean borders. We often hear it said that the drawing of maps in detail trains pupils to accuracy. Is there not enough useful or practical work which will afford the same discipline, without the loss of time and other injurious effects of the former? May not the same amount of care be bestowed on a simple outline as on a more complicated one? Elaborately finished maps devour much valuable time in making, and when completed do not afford any broader basis than the simpler ones for reasoning toward the life of the globe.

Moreover, very little of such work can be memorized, while the amount of labor and study spent on one of these maps would generally suffice to learn the general outlines of all the continents. It might profit those who spend so much time for the purpose of obtaining exact copies of the maps in their text-books, to compare such work with a small section of coast-line on a chart of the coast survey. It would doubtlessly save the children many hours of laborious imitation of book forms which, although very accurate in general contours, are very imperfect in details.

Modelling. — The first lesson on the surface of each continent should be given from a large relief map, modelled in the presence of the class, or previously prepared by the teacher, and should lead to the observation of the general arrangement of slopes, together with the general directions of coast-lines. A short description of a journey across the great valleys and plateaus, also a rapid voyage around the coast, may be given by the teacher, mentioning only such salient characteristics as will lead the class in imagination through the representation to the reality. The dimensions of the continent, expressed in miles, convey little, if any, idea of its true size; but an impression of immensity of area may be given by noting the lengths of time occupied in various trips across the surface.

Whenever new places are mentioned, they should be indicated on a relief map, and their names written upon the blackboard, just as in the elementary work. Pictures and supplementary reading aid greatly in leading pupils to see real land and water through the moulded forms.

After a lesson or two on the unity of the continent, and when the teacher is certain that the maps really recall natural forms of land and water, the pupils may study the relief by modelling it in sand, clay or putty, on the model-tins.

There are various ways of leading into the study of relief, among them the following: —

First. After the lessons upon general relief, as previously suggested, place a model of the continent before the class, and let them reproduce it *quickly* several times in sand upon model-tins, without any further aid. The quick modelling prevents dwelling upon unimportant details, and leads to the study of the great plateaus and slopes, just as rapid sketching leads to general outlines.

Second. Direct the order of study by modelling with the pupils, talking little, but requiring them to observe and imitate.

Third. Model with the class, at the same time describing the great slopes, in order to lead the imaginations out to the reality.

Fourth. Let the class reproduce from a model or cast, while the teacher or one of the pupils reads vivid but simple descriptions of the parts as they are studied.

Fifth. Ask pupils to describe orally the various natural regions before modelling them, obtaining their information from the relief models.

Then, too, the continents should be studied from the sea-level up the main slopes to the water-partings. That is, the sand may first be spread out evenly upon the tins; then the *general* coast-line traced in it; and finally the slopes built in the order of importance, back from the mouths of the great rivers to the water-partings or plateaus, the mountains being added last. As the pupils have already studied the general arrangement of slopes in the continent as a whole, this process of conscious synthetizing violates no law of concept growth. Very little time should be spent in making coast-lines in the sand, as they may be more readily learned by sketching.

In studying from water-partings to the sea-coast, the primary plateau should be modelled first; then add the long and short slopes and the secondary plateaus, care being taken to keep the true relative positions of highlands. Finally, when the main slopes of the river-basins have thus been located, the coast-line may be a little more carefully traced, and the principal mountain-ranges added. This is an excellent means of directing the attention to slopes, and in this regard is

superior to any of the others. Next in value to this is modelling from the sea-coast to the water-partings. All of the above devices have proven practically good, and may be used for variety in presenting the same continent many times.

Still another suggestion may be found helpful in high-school or college work in the geological study of structure; viz., to build the highlands in the succession in which they appear to have risen from the sea, thus considering slopes and river-basins chronologically. But as distribution in time belongs to geology, and only distribution in space to geography, such work would be out of place in the common-school system. Pupils should be required to depend very largely upon their own study of the model, all the above devices being used to incite to more careful and continued observation.

The individuality of the teacher will suggest various devices for directing the observation to particular features. Thus, when a handful of sand is placed in a mass on the location of a plateau, the child's mind is led directly to *elevation*. When the teacher moves his hand slowly from the mouth of a great river, drawing back the sand gradually to higher and higher portions of the continents, the very movement is suggestive of *slope*. In fact, this is one of the very best devices for holding the attention upon the relative positions of the slopes of the great river-basins. Drawing both hands at the same time from the mouths of different rivers toward the common highland between them, directs the attention to *water-partings*. The very movement of the hands in modelling thus becomes a powerful aid in directing the observations of a class. The pupils, moreover, will unconsciously imitate these movements in their own work, and so direct their own study to the essentials of relief. Other

mental effects may be produced by other movements, but these suggestions will serve to indicate a line of study for the teacher.

Lessons on certain plants, animals and races of men will also arouse intense interest in relief, besides making it appear more real. Thus the study of the camel, with his remarkable feet, knees, water pouch and food hump carries us directly to the burning deserts; the edelweiss tempts us to clamber over the crags and precipices of the Alps; in our search for birds' eggs, we are lowered in imagination over the high cliffs of the Norwegian fiords; the llama conducts us by a tortuous path up the mountain-sides, to the plateau of the Andes; the Dutch direct us to the lowland and dyke region of Europe. In short, we read about, or study in pictures, these forms of life, as another means of leading to the surface forms.

When pupils have acquired fair knowledge of the general relief, they should have reading-lessons upon the descriptions given in books of travel, geographies and geographical readers. They should be encouraged to bring to school any pictures, specimens or stories bearing upon the work, that would be of interest to their classmates. The heliostat, by giving views of various parts of the land-masses, will greatly aid the imagination. Observations should be guided by map questions also leading toward structure.

One of the very best devices for studying slope is that of making and drawing *cross-sections* of the sand models. Select such sections (see map on p. 161) as will show clearly the most important water-partings, slopes and river-beds; then cut the continents completely across, and draw away one part. The pupils should then sketch the sections thus made. The importance of this device cannot be over-estimated, as

it leads to study the *continents as solids*, which should be the underlying thought of relief or slope study. Cut the continents in various directions to show all the important slopes. Oral and written descriptions also should be occasionally required.

When two continents have been studied in this manner, compare their areas, general outlines, size and directions of plateaus, slopes, river-basins etc. In fact, *after one continent has been carefully studied, the work with each of the others needs include only the general features in which it differs from the one or more already learned*, together with the observation of the resemblances among all. By working in accordance with this very important principle of concept growth, much time and labor may be saved.

Ability to model and describe a continent quickly and accurately from memory may be accepted as evidence of a distinct mental picture. Pupils should not, however, be required to model from memory until the concept of the general form is clear. Until then always have an accurate relief map at hand for reference. The moulding sand should be laid aside just as soon as pupils can imagine the continental relief without its aid. Its further use would weaken rather than strengthen the imagination. There are occasions which call again for the moulded forms, when the relief is secondary to the study of rainfall, vegetation, history etc. These will be shown under their appropriate subjects.

Making the relief of one continent the basis for studying another, without stopping to relate the one to the winds, rainfall and life is the most economical order of subjects. It is as easy to reason the causes of the circulation of winds all over the globe as it is of the few that affect one portion of the surface, for in either case we go back to the same

influences of solar heating and rotation. Better study the relief of the continents in succession, and then relate the whole to the wind circuits.

There are, of course, differences of opinion as to the order in which the land-masses should be considered, and circumstances must to a large extent control this. If history is to be studied in the grade which is to begin the relief work, it would perhaps be better to work for a short time with Europe and North America from physical and political maps, dwelling upon them, however, only long enough to prepare to locate historical events by relief. Such lessons may be given at any time, and need not interfere with the orderly development of the science. The order of simplicity and sequence in relief would suggest the study of South America as a type, to be followed successively by North America, Asia, Europe, Africa and Australia. Some teachers prefer to begin with North America, and refer all the other forms to it. There is, of course, no essential order of study, and many valid reasons may be given for adopting the latter course.

According to the former plan, beginning with one end of the globe water-parting, we consider the land-masses in the succession of position to the other end. The Cape Horn end is selected rather than that of Good Hope, because South America in outline, relief and relation to winds is the most regular of all the continents, Africa being (except in outline) much more irregular. North America, next in order, is merely a repetition in structure of its southern neighbor, with a few more important details of coast-line, relief and drainage. Asia then repeats the structure more in detail, and with the north and south trend of axis replaced by the east and west.

Europe presents not only the peculiarity of great river-basins cutting through the primary highland, but also the most complicated of all the coast-lines. In general form and relief it should be considered as a peninsular projection of Asia; for not only is its highland a continuation of the plateau of Iran, but its great plain is merely an extension of Siberia, while both so-called continents share in the slopes of the Caspian Sea basin. Nevertheless, because of its commercial and historical importance, Europe is entitled to the rank of an individual. It is true that in relief it contains the typical section of a continent, but so also do many *parts* of other continents. The important study is not to determine whether it is a distinct continental division, but rather to learn its relief, and relate it properly to the other land-masses. Before considering Europe in detail, we may study the general relief of Africa, and thus complete the globe water-parting. Although the contour of the "Dark Continent" is quite regular, its surface is a vast expanse of anomalies. The relief of Australia needs occupy but a few lessons.

Coast-Line Drawing. — Map-drawing is a means, not an end, and has a higher aim than to train pupils to copy elaborate maps. The proper teaching of this important though much-abused branch presents an excellent opportunity for mental development. The motive of a teacher must determine his method of teaching, — subject, of course, to the laws of mind growth. Differences in method usually indicate differences in motive. A teacher whose aim is to obtain beautiful copies of maps will naturally present the work quite differently from one who tries to lead pupils to acquire clear concepts of general outlines of real continents. The former may be attained by tracing, by using instruments, by means

of construction lines, and many other hindrances to mental growth; but the latter demands activity of perception and imagination. A statement of motive ought therefore to precede directions for presenting the subject to a class.

The following suggestions are intended to aid teachers who strive to make map-drawing a means of developing the perceptive and imaginative powers, and at the same time enabling the pupils to obtain a connected and compacted body of knowledge essential to the higher generalizations of geography.

As healthful growth results from natural activity only, the employment of any devices which tend to hinder or cripple the full and free use of these powers should be condemned. Realizing that their pupils failed to grasp the important proportions of the continents, teachers have tried to remedy this defect by the use of "construction lines," thereby neglecting the opportunity to develop power to perceive general form. This is analogous to giving definitions of natural forms of land and water, instead of leading the pupils to *observe* the real forms, and *discover* their definitions.

Construction lines are general contours reduced to mathematics, and enable the class to construct upon paper, by supplied measurements, that which should be constructed in the mind by repeated acts of perception and judgment. The mind moves naturally in the line of least resistance, and that which it can reproduce mechanically incites little if any activity of judgment. Pupils may memorize the measurements given, but that will not enhance their ability to see a new continent or judge other proportions. If the motive is power, they should perceive, judge and express by their own efforts. *The only construction lines a child should use are such as he discovers in the relative directions of coast-lines, or*

in the trends of the principal plateaus and mountain-ranges which serve as chief water-partings to the great river-basins. The relative directions of such important lines may readily be judged by the pupils, if the teachers will but allow them an opportunity. Such lines *discovered* are *per se* evidence of clear concepts of general forms, and the individual effort to discover will tend to fix them permanently in memory.

Another device for preventing the exercise of the mental faculties in acquiring distinct ideas of continental outlines and proportions is known as "tracing maps." This does not apply to the employment of "outline maps" for "filling in" with productions, states, historical sites etc., but to their use, or rather abuse, in teaching coast-line drawing. The error arises from mistaking the meaning of the principle that "A child should never be allowed to see a wrong form," and that, as he cannot draw correct outlines at first, he should *trace* them. The fault is not in the principle, but in its application, as has already been shown in the chapter on modelling, p. 136. The best effort of a little child always approximates his ideal, and to him is not therefore imperfect. It is merely the language of his own mental picture, or the expression of what is already in his mind. We modify and gain concepts by impression, not by expression. The latter adds nothing to an idea, but only stimulates repeated acts of perception of, and comparison with, the exact copy, thus perfecting the concept by added impressions.

If we hold to our motive of development of power, we need not supply any such mental crutches as "tracing maps," or "construction lines." In fact, slowly tracing a printed outline repeatedly with a pencil or pointed stick, or relating the details of a coast-line to measured construction lines, rivets the attention upon consecutive details without once stimulat-

ing the mind to grasp the general proportions. All such devices make an excellent "bridge" over mental activity.

We often hear it argued that because children will not be required in future business life to sketch coast-lines from memory, it is therefore a waste of time to teach them this branch; and that printed outline maps should be used for "filling in" with physical features, productions etc. It is difficult to understand how such an argument can exist an instant in its own light, for does not the second condition utterly dispel the first? Do the exigencies of business life call for the construction from memory of physical and production maps more frequently than of contours? Then why supply the latter, and require pupils to make the former? Is it not because, in one case, ability to imitate a book-map has been made the *end*, while in the other, the drawing has been made a *means* of directing the study, and riveting the attention on the surface forms and products? This latter use savors of good teaching; but the former neither recognizes the educating value of the device, nor the importance of coast-lines in the later study. Printed outline maps doubtless save much time in studying the distribution of products, countries and cities, and in historical work, but have no share in the teaching of sea-coasts.

The only rational inference is, therefore, that coast-line drawing is omitted, and outline maps are substituted, because a knowledge of contours is judged to be unimportant. Can any thoughtful teacher entertain such an opinion, and yet recall the influence of great indentations, projections, and general directions of coast-lines upon ocean-currents, continental drainage, climate and productions, to say nothing of their historic value, and importance in studying the intellectual development of nations?

Or, if it is left to the child to imbibe his knowledge of contours from printed maps, might we not as reasonably expect him to do the same with regard to all map knowledge, and therefore do away with all map-drawing? Such a plan presumes too much upon the discernment and will of the child. The "bright" pupil might thus obtain a smattering, but what of the "dull" or slow one?

This *imbibing faculty* of children, although not recorded or described in our psychologies, has occupied a very prominent place in school-work. By means of it, pupils have been taught to speak fluently by studying technical grammar, to read by learning the A, B, C's, to think number by studying figures, — in other words, to hit one mark by aiming at another. But this boomerang teaching has had its day, and the shaft is now being sent straight for the mark. The fallacy of such work is self-evident. It is merely an extreme to which a few teachers have swung, and others followed, in an attempt to remedy the great evil of teaching unimportant details of coast-lines, instead of just sweeping them aside like so much rubbish. The subject needs winnowing, to separate the grains of useful knowledge from the chaff of details.

Then let us not forget that the device best calculated to develop power is also the quickest and most thorough means of acquiring practical information. Our readiest knowledge is that which has the greatest number of clear associations. These are made when relations are discovered. Such discovery here implies activity of perception or imagination, or both. A device, therefore, which quickens these mental powers, is best suited to the acquisition of useful knowledge. At the same time, the activity of mind in thus acquiring insures its development. Printed "outline maps" can never

supply the place of sketching, as a means of leading pupils to gain clear concepts of the general directions and features of real coast-lines.

The first few maps of a continent should be copied by the pupils from a relief cast, sand model, or other representation of the surface of the land-mass, in order that they may from the outset associate coast-lines with real relief. Contours are not mere lines to be learned by imitative drawing, but are the medium through which we may lead our class, in imagination, out along the world's ocean borders, to view them as the limitations of those portions of the great slopes that rise out of the sea. *Coast-lines should be studied from the standpoint of continental slopes* rather than of the line along which the land and water meet.

Suggestions as to how work in map-drawing may be profitably conducted, may perhaps be most clearly illustrated in the form of a class exercise. Let us keep clearly in mind that our aim is to lead the pupils to exercise their perceptive and imaginative faculties, in acquiring clear concepts of the coast-line of a real continent. They have been prepared for this study by mapping their school district, and can now *read maps* readily. We will take for our illustration the coast-line of *North America*.

A large model, showing the general outline and relief of the continent, has been previously made upon the sand table, and placed where the whole class can obtain a clear view of it. Pupils are directed to take places before the blackboards. This enables the teacher to supervise the individual work at a glance. Where there is not enough board room, the class may work in divisions, alternating between boards and desks.

As no construction lines are to be given, it is important

that the teacher so direct the exercise as to lead the pupils to prehend the general outline only, as a basis for the addition of details. This may be accomplished by allowing at first just sufficient time to represent the general directions of the coast-lines, with two or three of the largest indentations and projections; and by *holding the class to the allotted time.*

It is the customary practice to assign a much longer period for drawing each of the first few than for the subsequent maps. This, however, encourages the study of details, and prevents the observation of general form. A mind that is concentrated upon the reproduction of successive details cannot reach out to the relative directions of the great ocean borders: hence, the small and unimportant features remain isolated, and at the same time exclude the more important general concept.

Reverse the device; allow the least time for the first, and so lead the mind to grasp the general proportions. Let the period be so short that the eye must sweep around the continent, not resting an instant on the minor forms, the hand following rapidly in its wake. When the general outline is thus learned, allow more time, and the details will readily assume their proper places in the general contour. Even if the teacher presents at first to the class, for imitation, maps containing only such indentations and projections as should be memorized, the rapid sketching should be used, to direct the mind to the relative directions of the seacoasts. By means of this device we do away with the quasi necessity for construction lines, and restore to the child the opportunity for mental growth by natural activity.

Thus, the pupils are informed that only half a minute (or about as long as they can "hold their breath" easily) will

be allowed for sketching North America, and that they are to begin with the word *draw*, and stop when *time* is called. The teacher directs *ready*, and every eye is fixed on the sand model; *draw*, and the sketching is begun; just thirty seconds more, and *time* stops every hand. Teaching admits of freedom and ease; but all training, to be of greatest value and interest, should be conducted with precision. Pupils who did not complete their sketches tried, probably, to include too many details. By again limiting their time they will, on the next trial, look rather to the general outline. Erase and repeat the same exercise a half-dozen times or more, or until they can sketch the contour readily within the allotted time.

Another excellent device which may follow the one above given is to place before the pupils a large relief map, and require them, while holding a crayon at arm's-length between the map and their eyes, to draw the coast-line *quickly* in the air, and then immediately repeat the form upon the blackboard. The speed may be regulated by counting.

The exercise may also be varied by questions, referring to the relief map for answers: e.g., —

Which is the longest coast? Shortest?
What is the general direction of the Pacific shore?
Where is the continent broadest?
Where does the Atlantic approach nearest the Pacific?
In what direction has the continent greatest length?
Where is the longest strip of regular coast-line?
Where is the largest indentation? Next in size?
Which coast is the most regular?
How many large peninsulas on the Atlantic coast?
What plateau extends parallel with the Pacific coast?
What one lies along the Atlantic?
Which is longer, the Atlantic or Arctic coast?
What angle does the Atlantic coast make with the Arctic?

In each succeeding lesson, the work of the former should be carefully reviewed. Give daily practice in rapid sketching, but as further details are included allow more time.

The study of separate coasts, e.g., the Atlantic, may be begun after the general proportions have been firmly fixed in mind; but only the most important projections and indentations should be included. On this coast we might include the Gulf of St. Lawrence, Nova Scotia, Chesapeake Bay, Florida, Gulf of Mexico and Yucatan; on the Pacific side, the peninsulas of Lower California and Alaska; on the Arctic, only Hudson's Bay. These features, together with the general directions of the coasts, will prove sufficient until the pupils study commerce, and need to locate important harbors.

When one continent has been studied in this manner, the next should be learned by comparison with it; i.e., compare general forms, areas, lengths and regularity of sea-coasts etc. Should it be found necessary at any time to teach other smaller indentations or projections because of their geographical or historical value, such location should follow the above exercises. When the general form has been learned, the mind can readily relate any smaller parts.

The true test of a pupil's knowledge is not what he can sketch with a copy before him, but what he can reproduce readily from memory, as evidence of forms fixed in mind. Experience has shown that pupils not only gain far greater power by mastering coast-lines by their own efforts, but that they also learn to draw from memory more quickly and accurately. Moreover, each new continent is acquired in much less time than the preceding.

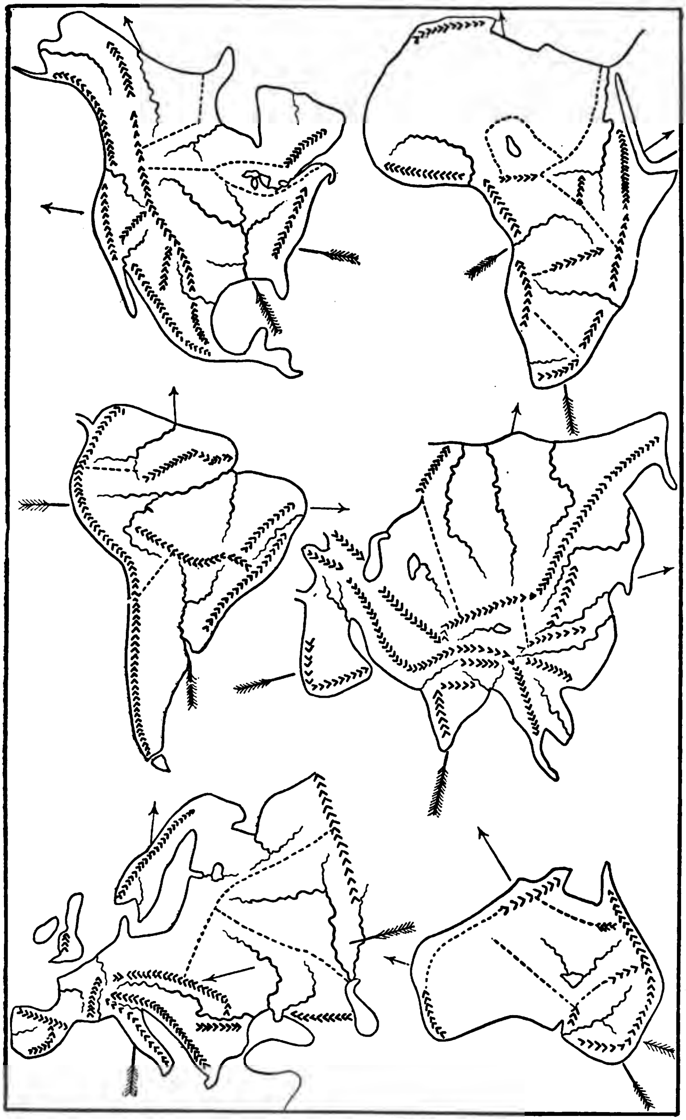
Instruction as to the character of the various sea-coasts, whether rocky or sandy, high or low, healthful or unhealthful, fertile or barren, may be given in connection with the re-

lief and climate of the continents. Enough should, however, be given here to keep the minds active in imagining real sea-coasts. The mutual influences of land and water may best be studied in connection with the winds, they being the medium by which the continents receive heat and moisture from the ocean-currents. Relative directions should be learned from a globe.

GENERAL DIRECTIONS REVIEWED.

The most important features of relief are the *water-partings* and *main slopes* of the principal river-basins.

1. Use such devices as modelling, reading, making cross-sections, map questions, and heliostat pictures, to lead to the study of slopes.
2. Lay aside the sand as soon as the imagination pictures vividly without its aid.
3. Teach modelling and map-drawing as means of developing perception of form, and judgment of proportions.
4. Aim also to accumulate practical knowledge.
5. Pupils should draw from relief models.
6. Use the blackboards often.
7. The first few sketches should be made in the shortest possible time.
8. Memory sketches indicate how much the pupils have actually retained.
9. Never force pupils to attempt to reproduce maps from memory until their concepts of general outline are clear. Till then use copies.
10. Written descriptions of surfaces and coast-lines should be occasionally required.
11. Coast-line drawing should immediately follow the study of slopes by modelling.



Essentials of Relief and Outline.

The map on p. 161 will serve to illustrate what features of relief and outline are judged to be of sufficient importance to study *at this stage of the work*. It will be noticed that the surface forms include the main slopes of the great river-basins, together with the mountain-ranges and other elevations only that serve as chief water-partings. No attention whatever is paid to the multitude of ranges that merely alter the courses of tributaries; neither are the numberless slopes of these branch-streams indicated, except by the general slopes of the basin.

A sufficient number of the large rivers are included to indicate the lines along which the main slopes meet; e.g., the Missouri locates the line of meeting of the slopes from the great western highland and the height of land, while the Ohio marks the lower edge of the slope from the height of land toward that of the Appalachian highland. Where the slope from the great Rocky Mountain water-parting meets that from the Appalachian, the Mississippi makes its bed. *The relief, then, includes such features only as affect the general continental drainage.*

Pupils should be able to reproduce readily from memory, by modelling and drawing, the physical features on these maps. It should be borne in mind, however, that *slopes* should be made the basis of the work, and that the lines locating the water-partings and rivers serve also to determine the main interlying slopes. This map also illustrates an excellent device for reviewing the chief features of drainage quickly and thoroughly. General contours should first be sketched by the pupils; the principal water-partings may next be located by shaded and dotted lines; and lastly, the lower edges of the slopes may be indicated by the great river-beds. The whole world should be often reviewed in this simple manner. The

arrows are placed to indicate the important cross-sections which the pupils should make by cutting through and across their moulded forms. There is no better device for leading to study the relative heights and lengths of slopes, than to make and draw repeatedly these relief sections.

QUESTIONS ON RELIEF.

Now that the continents have been studied as parts of the globe relief and as individuals, the pupils are ready to review the unity of the globe, and classify its general features. This will lead them to conceive more clearly their relations. The following questions and directions *for the pupils* may suggest one way to present this work. Answers should not be obtained from maps, but from their own concepts of the earth's relief.

What continents lie wholly north of the equator? south?
About what part of the land surface lies south of the equator?
What lands are crossed by the Arctic circle? Antarctic?
What ones by each of the tropics?
Where is the middle of the land-mass of the globe?
Find the middle of the water area.
What continents are triangular in outline?
What ones become narrow toward the south? west?
Draw the Atlantic coast in a single map; the Pacific coast.
Which is the more irregular?
Which has the largest indentations? Name the largest four.
Name the great peninsulas extending southward; northward.
What continents have islands lying off their south-east coasts?
What continental coast-lines extend toward the north-east?
What continents have great plateaus extending northward?
What plateaus increase in elevation toward the tropics?
What highlands trend parallel to the coast-lines?

What ones at right angle with coast-lines?

Which is the broadest plateau, more than a mile high?

Travel along the plateaus from Cape Horn to Good Hope, and name the great river-basins on the right; left.

What plains lie east of primary highlands? north?

What secondary highlands lie parallel to their primaries?

What ocean has the largest basin? bed? (considering the Arctic a part of the Atlantic, and the Indian of the Pacific.)

What ocean receives the largest rivers?

Which is the largest river-basin on the globe? the longest?

What basins drain into the Atlantic? Pacific?

What ones slope toward the equator? poles?

What great rivers flow toward the east? north? etc.

What valleys are drained into gulfs and seas?

What parts of the earth are inland basins?

What large rivers do not run into the ocean, or any arm?

Name the rivers that flow parallel to primary highlands.

What ones flow directly away from them?

What rivers cut through primary highlands? secondary?

What ones flow long distances on plateaus?

What ones have great waterfalls?

Which have formed cañons?

What rivers start from large lakes?

What ones start from the globe water-parting?

Name the largest three inland seas or lakes.

What large rivers have broad basins? narrow?

Where is the largest plain in the world?

What plateau contains the sources of the greatest number of large rivers?

What rivers have formed deltas? estuaries?

Sink South America five hundred feet, and draw its coast-line.

If the oceans were to rise one thousand feet, what plains would be submerged?

Draw all the continents as they would then appear.

CHAPTER XII.

B.—FORCES.

1. MOTIONS OF THE EARTH.

Rotation and Revolution.—The rotating earth, revolving with inclined axis around the sun, should be the basis of the study of heat and wind belts. Under this topic we consider rotation, because of its effects in "westing" all winds flowing toward the equator, and "easting" all flowing away from it; also revolution, because, by alternating the belt of greatest heat north and south of the equator, it occasions the monsoons.

The pupils have already, by their observations, been led to a partial conception of the grandeur and regularity of the motions of the heavenly bodies. They have also acquired the elementary ideas essential to the intelligent comprehension of a more complete explanation of the real motions; for just as the study of hills and valleys enables them to imagine the great water-partings and river-basins, so the observation of the earth, sun and stars prepares them to comprehend rotation and revolution.

It may be contended that observation in itself, if properly directed, will enable children to discover the earth's true motions; but as the conclusive evidence is found only in difficult mathematical computations, telescopic observations, and distant phenomena, it seems hardly reasonable to expect

such generalizations. Moreover, we should guard carefully against cultivating the habit of drawing conclusions from too few facts.

Thus, our belief in rotation is founded not only on the visible movements of heavenly bodies and the fixedness (?) of Polaris, but also on the deflection of winds and ocean-currents, the fact that the liquid ocean conforms to the spheroidal earth, the deductions of economy of motion etc. Likewise we look for proof of revolution, not alone to the changing path of the sun, the variation in time of the rising of stars, and the difference between the solar and stellar day, but also to the movements of other planets around the sun, the apparent annual elliptical paths of the stars directly contrary to that of the earth, verification of astronomical predictions based upon the hypothesis of revolution etc., together with the fact that all the apparent movements cannot otherwise be explained.

While phenomena visible to children may possibly lead a few to infer the truth, such inferences would necessarily rest on very meagre details, and the same appearances might be caused by daily revolution of the sun and stars around a fixed earth. For these reasons it was suggested, in the elementary work, that pupils be led as early as possible to observe from the standpoint of the true motions as explained by the teacher (see p. 97). These may now be more fully illustrated by a tellurian, or the common device of the "earth in a tub of water."

Fix a bright object very near the centre of the water surface, to represent the sun. On a light wooden or hollow rubber ball mark the equator, tropics and poles. Place it in the water, and weight it till exactly one-half floats above the surface, with the axis inclined $23\frac{1}{2}°$ from the vertical

position. Locate any spot in the ceiling toward which the axis points, and then, as the earth is moved in its orbit, keep the axis directed always toward that spot, which may be called the "north star." Once around the tub is a year, and the rotations, as well as the revolution, may take place. Teachers should not depend on experiments alone, but should lead the pupils, through the relative motions thus shown, to think of the real spheres in their orbits. In fact, at no time should these small objects displace in the minds of the class the greater forms of which they are the representations.

With this home-made tellurian, they may see illustrated the phenomena they have already observed, and may understand the causes of day and night, and change of seasons; why the sun rises in the east, but not always in the same place; why it changes its path across the sky; in what part of its orbit the earth is moving when each season opens; why the sun never comes directly over our heads; how it would appear to move if seen from the poles or polar circles; the variation in length of day at different distances from the equator; why places on the same meridian have the same time of day; why day and night are always equal at the equator, etc.

It is an excellent plan to repeat the elementary questions (p. 97 et seq.), and let the pupils discover reasons for what they were before merely asked to observe. This will prove intensely interesting. Incidentally, attention may be called to the fact that the earth's orbit is not quite circular, but slightly elliptical, and that the sun is not in the centre, but in one of the foci of the figure. This variation from a circle is so slight, that the tub represents more nearly the true form, than do the elliptical figures in their books.

The lines upon which the rays shine vertically when the axis is at its greatest inclination toward and from the sun

may be easily traced, and named tropics of Cancer and Capricorn. Also, as the sun lights approximately one-half of the globe, it is easy to locate the polar circles as the limits of light when the sun is over the tropics. The lamp and ball may also be used for this purpose. A few simple problems in "longitude and time" may be performed.

Then follows the study of hemispheres, and location by latitude and longitude. The pupils should locate the "prime" or rather zero meridian, and 180°; also 20° west and 160° east, those separating the hemispheres. It is well to memorize also one important meridian of each continent from which to estimate distances: e.g., 90° west, along which the Mississippi River flows; 60° west, passing through the middle of the table-land of Guiana and La Plata basin; 20° east, passing near the North Cape in Europe, and Cape of Good Hope in Africa; 90° east, in Asia, locating the mouth of the Ganges and crossing the middle of the plateau of Thibet; and 140° east, in Australia, near the mouth of the Murray River.

The tendency in this work will be to tell and teach too much. We should remember that we are only preparing to teach how the globe is heated, and what causes its winds.

Guard carefully against wrong conceptions being formed. It would not be surprising if even after long observation some pupils were discovered thinking that the earth is below and the sky above rather than surrounding us; that we dwell on the inside of a ball; that all the stars are overhead, or that they "go out" during the daytime; that during the night the darkness reaches to the stars, instead of being the little conical shadow of the earth; that bright stars are larger than dim ones; that the sky is a dome dotted with stars.

Heating. — This subject, which must precede that of winds, has been placed after the study of surface, as the relative positions of land-masses and their various reliefs exert a very marked influence on the distribution of heat and the directions of isotherms or lines of equal temperature. So many and so great are the modifications, that the exceptions are nearly as important as the rule. The climates of Europe and Africa are good illustrations of the value of studying the influence of position and surface forms.

We cannot locate isotherms until the distribution of winds, ocean-currents and rainfall, which greatly modify temperature, have been studied. On the other hand, we cannot study the winds until we have considered the general heating which causes the circulation. The two must therefore, in a measure, be studied together. We may at first unfold the general plan of heating; and then when the great belts of atmosphere are circulating as a *result of heating and rotation*, we may consider the physical influences that modify this general plan, and produce corresponding changes in the directions of the winds.

Referring again to the elementary lessons, we find that the pupils have already observed the effect of solar heat, during various hours and seasons, the relative intensity of slanting and vertical rays, and the influence of elevation and nearness to water on temperature. Applying this knowledge to the globe, they can readily discover that the belt receiving vertical rays is hottest, and that the heat gradually decreases toward the poles, save where plateaus, seas or other features interpose their influences; also, that the length of the warm season varies with distance from the heat-equator. Then the study of winds may be begun, and the modifications of this general heating may be noted as the work progresses.

2. WINDS.

The study of winds is almost wholly neglected in our common-school work; and yet no subject in the whole system is simpler, or fraught with better opportunities to develop reason and judgment, and at the same time impart more useful knowledge. No link in the whole geographical chain sustains greater weight. On the wind, with its gifts of rain, depend the great valleys for their fertility; a slight change in its direction may lay waste a whole continent, and bury its life in desert sands; its breath from over a warm ocean-current may give to one country perpetual springtime, while others in the same latitude are combating either stifling blasts from a desert, or chilling waves from a polar region. Wonderful is the influence of the wind, — pumping the life-bearing water from the oceans to sprinkle over the thirsty soil in obedience to a few simple laws, purifying the atmosphere and oceans, wafting the heat of the tropics far out into the regions of ice and snow, everywhere seeking to equalize temperature and redeem the barren land. It is the respiratory system of the organic globe.

Why, then, has not this important subject found a place in our course of study, below the high-school grades? Is it not because we have failed to discriminate the few simple laws that account for the *general direction* of its flow, or rather have lost sight of them in the labyrinth of forces that serve merely to accelerate or retard its movement, and cause local deflections? Yet there is a thread by which we may retrace our steps. It is true that while surface heating and rotation determine its general direction, many minor influences are also at work. Evaporation; the presence of vapor in the atmosphere; condensation; expansion; the location of great

deserts, mountain-walls and ocean-currents; the relative positions of land and water surfaces, etc., — are ever active in modifying the temperature and weight of the atmosphere, thereby tending to regulate the *speed*, and turn aside the winds temporarily in places. In many instances these influences counteract each other; e.g., evaporation, a cooling process, increases the weight of the atmosphere, but the product of this process, the vapor in suspension (?), diminishes the weight; and *vice versa* with condensation and resulting loss of vapor.

As geography has to do chiefly with general directions of the currents, would it not be better to omit these minor conditions that properly belong to physics; or, at most, if any of them are required, deal with such as parts of the vast machinery of motion which has its main-spring in solar heating and rotation?

The complexity of details accompanying the study of winds has forced this useful branch into grades beyond the reach of the masses of our children. By limiting the work at first to these general causes, and introducing at a later period the conditions that modify speed, it may be easily adapted to its proper place in the science or course of study.

Even if the subject is judged too difficult for children of this grade, rather than omit this important step, it would be far better to *tell* them, with a simple explanation, the directions of the trades, return-trades, and principal monsoons, leaving the reasoning process till a later period. The rainfall cannot be intelligently studied till the directions of these great currents are known.

In preparation for this step, the pupils have been led to observe the lighter fluid floating upon the heavier; the heating of the atmosphere by the earth's surface; change of tem-

perature with elevation; unequal heating of different kinds of matter constituting the earth's surface; the tendency of a moving body to "continue in a state of uniform motion in a straight line;" how the globe is heated, and its rotation. Only such belts or paths of winds should be studied as bear moisture to large tracts of land. Local winds may be omitted till their localities are studied in detail. Those of chief importance are the trades, return-trades, polar, and extensive monsoons (see map, p. 175).

The work consists in *leading* the pupils, by questions and drawings, to apply to the globe that which they have already observed and learned. They will readily discover that as a result of the manner in which the globe is heated, the heavy polar air will flow along the surface toward the equator, becoming gradually warmer, and will lift or float the warm air of the torrid regions, which will then flow as upper currents toward the poles, north and south; also that because a body in motion tends to continue in a straight line, the rotation of the earth will only gradually deflect the polar currents as they cross larger and larger circles, on their way to the tropics; and as the earth rotates away from the winds, the "lagging" will produce the effect of a westerly flow. Thus they infer that winds flowing toward the equator are deflected to the westward. They are then told that within the tropics, these are known as trade-winds.

In tracing the return upper currents, no difficulties are encountered. The air, in rising from the equatorial belt, becomes cooler, but cannot come down within the tropics for the same reason that paper or flour will not settle upon a register from which a current of air is rising; and as the flour finally comes down just beyond the hot-air column, so these cold upper currents often reach the surface just without the

tropics, and displace the polar winds. By the same law of motion applied above, these winds, which have acquired very nearly the velocity of rotation of the torrid zone toward the east, will move in this direction more rapidly than the land in the smaller and smaller circles across which they must flow. Currents flowing away from the equator are consequently deflected to the eastward. When these currents reach the surface, they are known as return-trades.

The general circulation may then be reduced to these simple laws: First, solar heating causes a surface flow of the atmosphere toward the equator, and a return upper flow (which often becomes a surface current beyond the tropics) toward the poles. Second, the rotation of the earth produces the effect of deflecting the former to the westward, and the latter to the eastward.

The principal modifications to be studied are the monsoons, which, as their name implies, result from change of seasons. The pupils have already discovered the cause of the land and sea breeze, and the fact that air, if free to move, will always flow from a cold toward a hot surface. They will readily reason that when the sun is in its northern path during our summer, the lands this side of the equator become superheated, the atmosphere becomes rarefied, and the current tends to the northward; that during our winter the opposite current prevails; also, that the effect is not so marked between two water-surfaces, as the difference in temperature is comparatively slight. Thus they account for the monsoons between Asia and Africa (see map, p. 175), Asia and Australia, across the Gulf of Guinea, between the west coasts of Central and South America, and from the basin of the Orinoco to the sea, and *vice versa.*

The trades of the Indian Ocean having been turned into

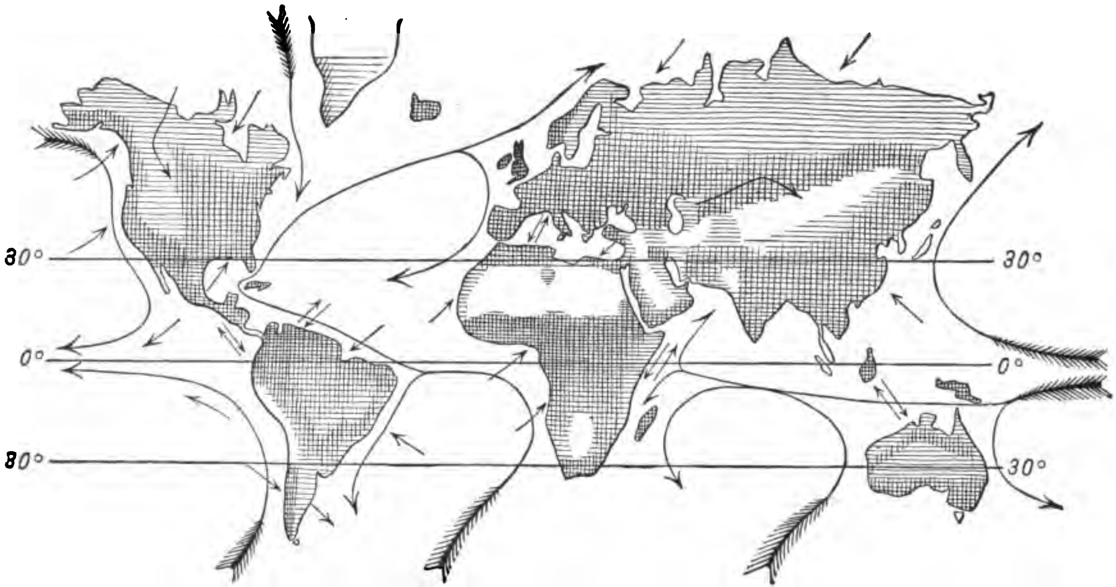
these "season breezes," it is plainly to be seen that the desert and equatorial regions of Africa would cause a flow from the Atlantic and Gulf of Guinea toward the east and north-east, over the continent. It is equally evident that a heavy cold wind, flowing up the Mackenzie valley from the Arctic shores, would be forced to flow toward the south-east by the western highlands, resulting in the cold north-west winds that often sweep over the lake-region and upper Mississippi.

3. OCEAN-CURRENTS. (*See map, p. 175.*)

The study of ocean-currents needs occupy but little time, and yet ought not to be neglected. It should be confined, however, to such as affect the climate of large land-masses. For the present, we may limit our work to the equatorial currents, and their two main branches, — the gulf stream and Japanese current, which give to Western Europe and North America their mild climates. The principal polar currents may be incidentally noticed, because of their climatic influence upon the south-western coasts of South America, Africa and the north-eastern part of our own continent. These are not so essential, however, as the first-mentioned streams.

Although it is not true of all ocean-currents, there is but little doubt that the equatorial, gulf and Japanese streams are controlled by the identical forces that move the winds in the same directions along their surfaces; with this modification, however, that the former are interrupted by the continents. The speed of these streams may be largely the result of the winds, but their general directions are probably determined by solar heating and the rotation of the earth.

It is without doubt true that the directions of prevailing winds, excessive evaporation within the tropics, the extreme saltness of equatorial waters, the configuration of the



Winds, Ocean-Currents and Rainfall.

ocean-beds and other causes should be considered in a more extended survey; but our work with children would hardly admit them. As both of these great fluid coverings are susceptible to the same influences of heat and rotation, it is difficult to decide just how much they effect each other. The effect of winds upon ocean-currents is, however, very marked in the Indian Ocean, where the Malabar current turns directly back upon its course, and flows with the monsoons, within a few days of the change in direction of the latter. The whole Antarctic drift is also deflected to the eastward by the southern belt of return-trades.

The important facts to be considered, aside from the *directions of the main streams*, are the temperature of the water, i.e., *whether from a hot or cold zone*, and the effect of this upon the temperature and humidity of the winds passing over them toward the continents.

It will perhaps be sufficient, in supplying this link to the geographical chain, to merely call the attention of the pupils to the fact that the great ocean-currents have the same general directions as the winds blowing along their surfaces, and that such currents divide near the shores of the continents against which they flow. Thus they will study the great equatorial currents of both Atlantic and Pacific, corresponding with the trade-winds; the gulf stream and Japanese current, with the return-trades; and the cold ocean-currents from the south which are blown against the west shores of the southern continents.

4. RAINFALL. (*See map, p. 175.*)

Pupils have been prepared for this step by observations showing where moisture in the air comes from, how clouds are formed, what moves them, and what condenses them in

the various conditions of rain, dew, snow etc. They know that during the warm months bright flashes of lightning are generally followed by pouring rains; that vapor will condense upon any substance colder than saturated air; that the invisible vapor in breath becomes a visible cloud when it comes in contact with very cold air, and even forms drops of water and lumps of ice upon beards and clothing; that increase in elevation is accompanied by decrease in temperature: in short, the elementary work has prepared them to distribute rainfall over the globe by the application of the simple facts they have observed.

Knowing the directions of the winds, they can readily determine, by their knowledge of relief, which of the great continental slopes lie in the paths of moist winds from the sea, and which are deprived of moisture by intervening plateaus or broad land-masses. The error is not by any means rare, of teaching or rather telling that the rainfall in great river-valleys results from the flowing of moist winds against or over the cold primary highlands. But this is only a part-truth. It may result from lightning, meeting colder currents of air, or change in temperature while passing over lower table-lands or mountain-ridges.

The study should decide whether the highest plateaus lie between the moist winds and the valleys, or on the lee side; for, if a great quantity of vapor floats in, it will be condensed by one or more of the above causes. Of course, in very hot desert regions where there is not sufficient moisture to saturate the air and form clouds, and where there are no high plateaus, there can be little if any rainfall.

The two great desert belts extending around the globe, under and a little beyond the tropics, are easily accounted for as the zones upon which the winds descend after rising in the

equatorial belt of calms. As an ascending current, the air loses its rain; but in descending it becomes gradually warmer, and absorbs moisture. Thus the middle heat-belt, moving northward and southward with the sun, receives heavy rainfall; while the tropical calm-belts are branded by such great desert tracts as Sahara, Arabia, Iran, Gobi, Kalahari, Atacama and Middle Australia. These great fever-sores are, of course, in many instances greatly aggravated by surrounding table-lands which keep from them the healing waters that might otherwise reach them in local winds.

Other conditions affecting general distribution are explained without difficulty. Thus, owing to decrease in temperature with distance from the tropics, there must be a corresponding decrease in evaporation, and consequently in rainfall. Again, the surfaces of broad plateaus tend rather to heat than cool the passing winds; and even when not surrounded by high mountain-walls, they receive but little moisture.

An excellent plan for unfolding this subject is to sketch upon the blackboard a map of the world on Mercator's projection, showing the principal plateaus, wind-belts and ocean-currents; then to let the pupils decide *which slopes are open to the moist winds.* The teacher's work is to merely direct the reasoning by questions, now and then calling attention to the influence of deserts, ocean-currents or seasons, upon the directions of winds in particular localities.

5. CLIMATE.

The distribution of climates is merely a review of heating, winds and rainfall combined. The study includes temperature as affected by distance from the equator, and elevation; length of season; trend of highlands; direction of winds;

winds from deserts, ocean-currents and ice-fields; amount of rainfall; and vapor in the air. It should lead to the study of isotherms, or rather broad belts of nearly equal temperature, as a preparation for the distribution of life.

First, however, the earth should be reviewed in great *natural* regions, requiring the pupils to explain the causes that determine climate. For example, the valley of the Amazon is assigned, and they may reason as follows: "It lies wholly within the tropics and in the path of the trade-winds. Its surface is mostly low-land, and is crossed by the equatorial rain-belt. Its climate is therefore warm and moist."

When the pupils have reasoned the principal conditions, a great deal of supplementary reading should follow. Use every reliable text-book or story of travel available; and when a region has been thus studied, assign it for an oral or written language lesson. After the whole surface has been thus considered, let the pupils locate lines of equal temperature as nearly as possible. Only the principal ones should be studied, or such as limit great belts of vegetation, for we are now leading toward the distribution of life.

We have already found the average annual temperature, the length of the warm season and longest day, and the prevailing winds, in our district. We may now trace the belt having nearly the same temperature around the globe. To illustrate: The pupils found the average temperature of their district to be 48° F. A map on Mercator's projection, showing the principal physical features, is sketched on the blackboard. The location and average temperature are properly marked, and then the journey eastward begins. The teacher leads the way with questions, and accepts no answer unless accompanied by a reason. Pupils cannot, of course, determine the exact line; but after they approximate, the

teacher should verify or correct. As our aim is to develop reason and judgment, the questions should suggest no part of the answers, but merely direct the line of investigation. Only the chief influences should be considered.

Thus the pupils decide that in crossing the gulf stream the line will bend quite a distance toward the north-east. Some think it will run north of Ireland and Great Britain; others, recalling the shorter days and colder seasons of the North, judge that it will extend just south of these islands; still others, that it will pass between these extremes. After they have discussed the principal conditions, the teacher tells them that it runs through the middle of Ireland.

Then they decide that in crossing from Western to Eastern Europe the line will move southward, as the influence of the warm ocean-currents diminishes, and the Alps shut off the warm south winds. It is prevented reaching too far south by the warm return-trades sweeping across the eastern Mediterranean, Black, Caspian and Aral Seas; and so our line is run just north of these. Approaching the highlands of Eastern Asia, it will of course bend southward again. Reaching the Japanese current, it swings almost as far northward as when it crossed the Atlantic.

Entering the United States about on its northern boundary line, it dips far southward in crossing the great western plateau; then returning northward as it enters the warm slopes of the upper Mississippi basin, it extends almost due eastward to our district. This single important journey shows what an excellent opportunity the subject presents, not only to develop power to see relations, but also to review and *unify all the preceding steps.* Aim to keep the work within the grasp of the children, and wait for them to *grow* to the answers.

In like manner discuss the causes that vary the line of greatest heat (thermal or heat equator) from the light or astronomical equator. The pupils know that this line is much warmer than their own latitude; but they cannot determine its exact average, nor do they need this knowledge.

Trace also the natural heat boundaries of the various belts of vegetation: i.e., the tropical, semi-tropical, temperate, cold-temperate, and arctic. It would be of no assistance to the children to memorize the mean annual temperatures of these lines. The object in locating should be to study the conditions that vary the lines of heat from the lines of light usually studied. The former, being the basis of study of distribution of vegetation, are of far greater value than the latter.

6. SOIL.

Although a very essential part of the system, the study of the distribution of soil presents very little that is new. The material is at hand; we have merely to build. Soil-making, in the elementary lessons, has shown what agents are at work preparing and distributing the food for plants. The pupils can now look out over the whole world, and locate the *fertile valleys*, receiving a plentiful supply of heat and rain; the higher *pasture lands*, with less moisture and colder climate; and the *barren tracts*, seldom, if ever, visited by refreshing showers. Soil is to be studied in relation to relief, rainfall and temperature.

The work under this head may take the form of constructing maps, showing the general distribution of the various grades of soil in the world. If the previous subjects have been carefully studied, the pupils can do this without any assistance. By the readiness with which this

step is taken, the teacher can judge of the thoroughness of their knowledge, and their power to use it.

When the maps are completed, the children should state their reasons for apportioning the various grades of soil to the particular natural regions. Ability to construct intelligently from memory soil-maps that are accurate in *general* outline is good evidence that the whole subject of natural geography has been well taught.

REVIEW.

The best test, perhaps, of the power of the pupils to see relations, form judgments, and apply knowledge already acquired, is to reverse the earth's rotation, and lead them to determine, with as little aid as possible, the *general* effect upon the winds, ocean-currents, rainfall, climate and distribution of soil.

. . . .

We may now understand more clearly why the study of relief has been so strongly urged. Not only have we made it the basis of every step, but each subject has also led us to a clearer and more intelligent conception of the plan of the whole. Although we delayed long enough only, at first, to obtain a general view of the arrangement of plateaus, slopes and river-basins, we shall find that now the picture is much more complete, for we have been adding to it and viewing it from a new standpoint with each succeeding step. In fact, each subject was merely a call to study the earth's surface in new relations. Relief has been the cynosure of thought, and by keeping it ever before us, we have now climbed to another height from which to view the life of the globe.

CHAPTER XIII.

C.—LIFE.

1. PLANTS.

DISTRIBUTION of vegetation should be studied from the standpoint of both heat-belts and natural regions; the one leading to the grouping of plants in great heat belts, the other referring the families more directly to their appropriate soils; the one recognizing the unity resulting from the globe form and solar heating, the other resolving this unity into its great natural parts, thus bringing the distribution into closer association with surface features.

Preparation has already been made for both classifications. The pupils have discovered the simple laws that regulate plant life; i.e., its relation to heat, soil and moisture. True, they do not know what conditions are necessary to the growth of the various species, but they have observed and studied the facts essential to the distribution of the great families, and are now prepared to locate them. Thus, they know that sugar-cane and cotton can be grown only in sections having rich soil and a long warm season; that most cereals will ripen in a short, warm summer; that nearly all varieties of palm require very warm climate; that the pines thrive in cold regions, etc.

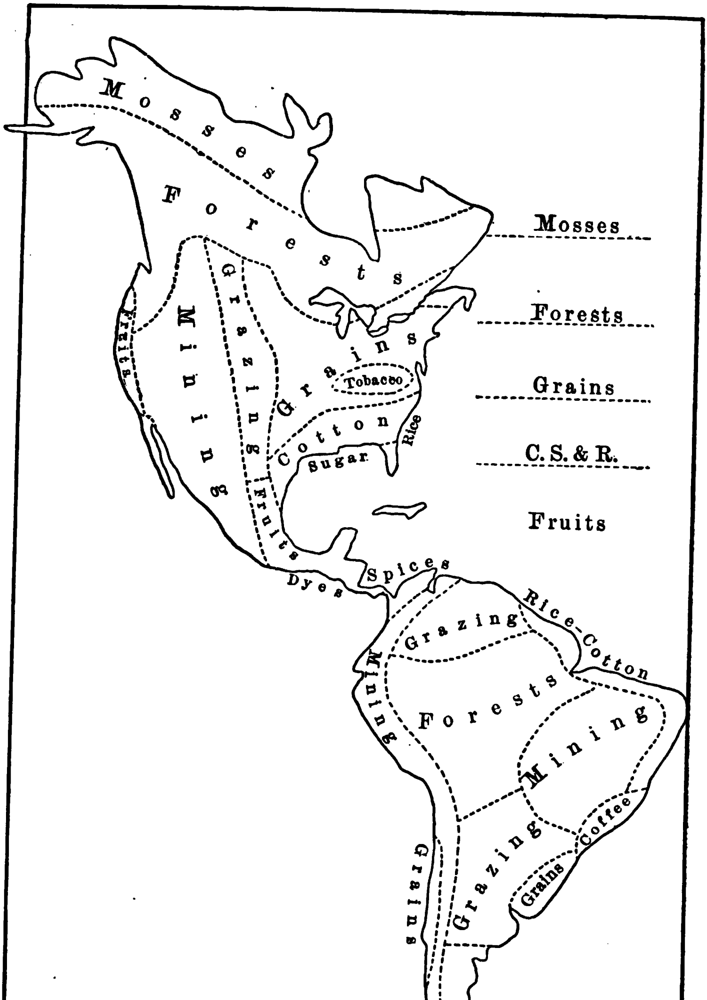
The most uniformly dispersed and therefore most characteristic plants of the climatic belts are the *trees*, and from

them the zones may be named. That between the *heat lines* of 70° north and south (tropical) is often termed the zone of *palms;* between 70° and 60° (semi-tropical), of *evergreens;* between 60° and 40° (temperate), of *hard woods;* between 40° and 30° (cold-temperate), of *pine* or *soft woods;* between 30° and the poles (frigid or arctic), of *shrubs and mosses.* Of course the children should not be required to memorize these temperatures. They are stated here merely to illustrate the manner of determining the natural boundaries of the zones.

It should be borne in mind, that the vegetation of any belt may be found also in regions of longer seasons and higher annual temperature. Thus maize, found in temperate climates, growing side by side with the hardier grains, may also be grown in nearly all the warmer sections of the earth. This accounts in part for the overlapping of zones. The principal limitations to be considered are *rainfall and length of warm season.*

When the general distribution in heat-belts has been made, we may group vegetation upon the basis of relief. That is, we determine where the relief of each continent divides the surface into great natural regions, with conditions of climate and soil favoring the growth of particular families. These conditions have been already studied under rainfall, climate and soil; and there remains only the distribution.

As there are often barriers, such as oceans and deserts, between similar regions, preventing the dispersal of plants, it happens that some sections are destitute of valuable food-plants (to the growth of which they are naturally adapted), and remain so until such products are transplanted by the hand of man. Pupils cannot be expected to trace the plant families from their centres of origin, or study the history of



Plant Regions of America.

their dispersal. The main work should be, not to account for the present distribution, but to study the conditions of heat, soil and moisture that adapt the great families to their habitats or floral regions.

Many helpful devices may be used to aid pupils in associating the products with their appropriate localities, but the question of *how* they are adapted should always precede. One excellent plan is to model the continents, and place upon each natural region some part of the characteristic vegetation. For example, upon a relief map of North America place some rice along its south-eastern shores, then successively northward from the Gulf of Mexico, a little cotton or cotton cloth, a few kernels of maize, a small strip of linen cloth, some grains of wheat, a piece of pine or spruce, etc.

When the surfaces are thus covered, the pupils may sketch the coast-line, and then represent the different regions of productions by coloring or shading. All the grain lands may be indicated by yellow; the forests, dark green; the grass lands, light green; cotton and sugar-cane, white; tropical fruits, red, etc. We should teach the distribution of staple or valuable commercial products only, as the work is now leading toward the commerce of the world. The production map on p. 185 indicates the general distribution of the families of the New World. Pupils should be able to reproduce these from memory. The same regions are continued across the eastern hemisphere, save where the plateaus and mountains interpose grazing-lands and mining districts.

2. *ANIMALS.*

One of the most poorly taught subjects in common-school geography, if indeed it can be said to be generally *taught* at all, is the distribution of animals. It has become mere

memorizing of groups characteristic of the various continents and smaller political divisions, with little, if any, attempt at discovering the simple laws that govern their dispersal. In losing sight of controlling influences, teachers have fallen into the error of grouping animals in political divisions, instead of great natural regions.

In our text-books we see one picture showing the characteristic families of Europe, another of Asia, and still a third of Africa; entirely ignoring the fact that all Europe, Northern Africa, and all Asia except Hindostan and Farther India, constitute a single faunic region, — i.e., have common characteristic families, — while the southern and middle parts of Africa differ even more widely from the region north of the Sahara than does Europe from North America. The same conditions exist in the grouping in the New World, the natural dividing line being the high plateau of Mexico, and not the political boundary on the isthmus.

In fact, no continent except Australia has a fauna peculiar to itself; and this leads to the remark that continents are natural divisions of the globe land-mass only in so far as important natural features have been selected as political boundaries. The natural continents of the eastern hemisphere, as indicated by plant and animal life, races of mankind, governments, religions, states of society, and all other natural outgrowths of physical and race (?) conditions, are *Afeurasia* (*Af*rica-*Eur*ope-*Asia*), lying north of the great desert belt and plateau of Thibet; *South Africa*, the region south of the Sahara; *India*, south of Thibet, including the structural prolongation in Farther India and Southern China; and *Australia*. Dividing the western hemisphere at the southern edge of the plateau of Mexico into North and South America, we separate the globe surface into six *natural*

continents. Nor is such a division without value; for future science, whether it be botany, zoölogy, ethnology, theology or sociology, must recognize these structural limitations.

We can arrive at an intelligent grouping of animals through the study of climate only, in its effect upon the distribution of food-plants. The adaptation of animals, by their structure and coverings, to their physical surroundings has been already observed in the Elements. Their means of defence and dispersal have also been studied, together with the barriers that prevent migration. Their natural limitation to regions producing their various kinds of food, has been clearly illustrated by the study of habitats of species in the school district. In short, the elementary questions in this, as in all other parts of the system, have prepared for the distribution in natural regions.

To accomplish this, we should first decide what species or families merit our study, either because of their commercial or scientific value. Many have already been studied; very few need be added. We next determine to what regions they are adapted by their food and covering requirements. Now the teacher or book must come to the assistance of the pupils; for, while the organization of certain animals adapts them to a section of country, they may not occupy it for the simple reason that physical barriers lie between it and their place of origin. We cannot reason, therefore, that because existing conditions of a region are favorable, certain animals must consequently be found there.

A really scientific study of distribution would go back to the time and place of origin of the various species, and trace their migrations through successive periods and changes in the globe structure. We might then be able to account for such facts as the absence of horses and cattle from the plains

of America, at the time of the coming of Europeans, although the conditions were so favorable to their development; or the disappearance of lions, horses, camels and elephants from the western hemisphere, where formerly they roamed in great numbers. But this distribution in *time* belongs to historical geology, and only the present distribution in *space* to geography.

Our work, then, is rather to study how the great families are adapted to their homes or habitats, and the natural barriers of climate and relief that limit them in faunic regions, than to account for their presence there, or absence from other lands, where the conditions favor their development when once transported.

The principal barriers to be considered are such as modify climate, and thus affect the distribution of food, e.g., physical features, such as oceans, deserts, forests and plateaus that are impassable to members of the fauna; also the presence of other animals that would destroy the new-comers.

The following groups of animals are based upon the valuable work of Wallace, "Geographical Distribution of Animals," with such omissions as its adaptation to children rendered necessary. The boundaries selected correspond so perfectly with important physical features, that any explanation seems unnecessary. The pupils can readily discover the conditions that have led to this division into natural regions, and can without doubt account for the support of the great families in their appropriate homes.

The portions also of each natural continent which various families occupy may be easily traced to climate, in its effect on the distribution of food. Thus, in *Afeurasia*, the reindeer and fur-bearing animals must live in the northern part; the horses, cattle and sheep, in the middle and south-

ern; the buffalo, camel and lion, in the southern, etc. This distribution in belts should be studied as carefully as that in the natural continents.

Distribution should be studied on relief maps; and the physical features which chiefly limit dispersal should, of course, become the basis of memory of location of the families.

CHARACTERISTIC GROUPS OF ANIMALS OF THE NATURAL CONTINENTS.

NOTE. — In addition to the following list, it should be borne in mind that horses, cattle, sheep, swine and other domestic animals are now found over nearly all parts of the earth.

1. *North America (cf. Afeurasia).* — Polar and brown bears, whale, walrus, seal; moose, dog, beaver, otter, fox; bison, big-horn, black and grizzly bears, wolf, prairie-dog, opossum; turkey, eagle, duck, goose, prairie-hen; alligator, rattlesnake, cochineal, sponge, coral; salmon, whitefish, mackerel, cod, herring, oyster.

2. *South America (including Central America).* — Llama, alpaca, vicuna; monkey, tapir, peccary, jaguar, ant-eater, armadillo; crocodile, boa, iguana; condor, rhea, parrot, toucan; innumerable insects and bright-colored birds.

3. *Afeurasia (cf. North America).* — Polar bear, seal, whale, walrus; reindeer, elk, beaver, otter, fox; horse, yak, camel, ass, antelope, Cashmere and Angora goats, sheep, lion, leopard, bear, wolf, moufflon, boar, chamois; pheasant, eagle; silk-worm; coral, sponge, pearl-oyster.

4. *South Africa (south of Desert).* — Gorilla, chimpanzee, lemur; lion, leopard, elephant, giraffe, rhinoceros, hippopotamus, zebra, quagga, eland, gnu, buffalo; crocodile, python, chameleon; ostrich, ibis, flamingo.

5. *India (the Orient).* — Orang-utan; elephant, tiger, leopard, bear, ass, buffalo, zebu, swine, rhinoceros; crocodile, cobra; peacock, pheasant, parrot; silk-worm; numberless insects and beautiful birds.

6. *Australia.* — Kangaroo, echidna, ornithorhynchus, wild dog; lyre-bird, bird-of-paradise, apteryx, emu, cockatoo, black swan.

No greater error could be committed than to require pupils to memorize these lists of animals. It is not even necessary that they remember where every animal is found. The aim should be to give them a general view of the characteristic animals of each faunic region. It is important, however, that the habitats of the chief commercial animals should be fixed in mind.

It is an excellent plan to have the pupils model the different continents, and place some product or picture of each animal in its appropriate region; then draw the same, write the names, and file away with the plant-maps for use when studying occupations and commerce.

CHAPTER XIV.

D.—MAN.

Political or civil geography belongs to history, and comes naturally under the head of movements and development of races, of which it is the direct outgrowth. The order and manner, however, in which the great events of the past are at present studied in the majority of our schools preclude the proper development of this important subject. The vast amount of worthless historical details that our pupils are forced to retain for examinations is a remarkable illustration of mental endurance. The wonder is that the imaginations and memories survive even as mere wrecks, considering the work they are called upon to perform. The highest aim of history teaching should be to cultivate a taste for historical reading by giving the imagination good wholesome food, and stimulating its appetite in the proper direction; for as it is fed, so will it finally crave.

When history records the social and intellectual development of a people; when pupils are taught to trace the great movements of nations; and when they can, by their previous study of relief, follow along the grand stage of history, raising the great curtain of the past from the interesting events that have changed the face of large portions of the world, — then will an appetite not only be quickened in the right direction, but such a course will also become a basis for all

future historical reading, and lead to the intelligent study of civil geography which is now merely the memory of ever-changing political boundaries.

1. RACES.

Geography and history should go hand in hand at every step in the study of mankind. In fact, it is impossible to separate them unless we confine the former to the study of present distribution without attempting to lead back to causes. The previous work has, however, prepared for something higher. We may at least trace the surface and climatic limitations of races, occupations, commerce etc.

It is true that although in his primitive state nature places nearly as much restraint upon man as upon the lower animals, yet with his developing power he gradually frees himself, and makes his very bounds his support and protection. Freedom is the measure of civilization; and man of to-day has worked himself free to such a degree, that although his former prison-walls still stand in the form of great plateaus, deserts and seas, they are as monuments to his enterprise, and a guide to his past movements.

Many traces of this influence of relief, especially on the lower races, still remain. Save where the white man has wedged himself in, Equatorial and Southern Africa present a race of men quite as peculiar as their fauna; while the northern shores belong to the Caucasians. Australia is another marked illustration. As we approach the higher types of mankind, however, the barriers as such gradually disappear. The plateau of Thibet, and its continuation along the Hindoo Koosh and Caucasus, still separate the Mongolic and Indo-European races; but in Russia and Farther India, the limitations are being rapidly overcome. Even in North America,

the white race is pressing along the same lines of relief that limit the sub-regions of the fauna; and in South America, the long plateau still separates the two branches of invaders, Spanish and Portuguese.

What is true of races is also to a large extent true of governments, religions and states of society. Their bounds are almost identical with race limitations, and why should they not be?

Although it may be difficult to base distribution at present upon history as related to geographical influences, we may easily lead our pupils to observe the present relations of races to natural boundaries, and thus at least open a line of future study for them, making the discovery of cause the basis of memory of effect.

If the children have become familiar, in the elementary work, with the various races, they are now ready to people the globe. This needs occupy but a very short time, as they can readily memorize locations upon the relief they have learned. All boundaries should be indicated at first upon relief-maps, and from them be transferred to paper. The chief aim should be to learn what part of the general relief each race occupies, and no time should be wasted in the study of arbitrary lines that are at any time liable to change.

2. RELIGIONS.

What odd conceptions most children form of the great religions of the world! Mere names, or at most representing to them only the ignorant superstitions of wicked and idolatrous nations, instead of the grand outgrowth of ages of investigation and thought toward a first great cause. A few short lines in the text-books, perhaps half a column, and these hurried over generally without comment or explanation,

constitute the child's source of knowledge of one of the greatest factors in the history of civilizations.

Remove from, e.g., the history of Europe, the great events that have resulted from religious movements, and what a mere skeleton remains! Separate from all ancient history the long line of migrations, wars and other events arising from religious causes, and the isolated fragments could never be united.

But what preparation are we giving our pupils for their future reading and study? What interest are we seeking to arouse in this interesting and practical work? If this important subject is to be included in geography, instead of in history where it properly belongs, it should be taught as carefully and thoroughly as any other part.

The work suggested for the lower grades should be continued through the higher. The central truths or doctrines (not creeds) of each of the great religions should be known, together with any peculiar forms or important ceremonies. A part of the supplementary reading may tend in this direction, and prove a very interesting introduction to these great nations. The mere distribution can be learned in a very short time, as it has been subjected to the same physical influences as races, governments etc.

3. GOVERNMENTS.

The various forms of government should be distributed in the same manner as races, since the former lead us to study merely subdivisions of the latter. All the great nations of the world reach out on nearly every side to natural limitations, and these should become aids to memory. Pupils should trace the principal features that separate countries, and locate chiefly by their means; losing no time in "bounding" all the

little states of the world, or memorizing variable artificial boundaries. That is the province of the atlas. Neither should they enter into the details of small and unimportant governments.

Capitals of the principal countries should be located; but we should not forget that there is a limit to the mind's power of retention, and should therefore seek to store it with only the most useful and practical knowledge, leaving the less important to books of reference.

Following the subjects of occupations and commerce, the governments of the United States (see p. 202), England, Germany, France, Spain, Russia, Turkey, China, Brazil and perhaps one or two others should be carefully studied because of their current historical value. This will enable pupils to read more intelligently from the newspapers, — the broadest and most reliable sources of information among the masses.

4. OCCUPATIONS.

It has been already stated that occupations among civilized nations are largely determined by the possibilities of natural production. This subject, therefore, naturally follows the study of distribution of plants, animals and minerals. It was thought best, however, to insert the lessons on Races, Religions and Governments, in order that Occupations and Commerce might be made a means of reviewing the previous study of relief and life from the stand-point of political divisions or countries; and also, that the pupils might first become somewhat familiar with the various nations whose work and commercial life they are now about to study.

As a result of their previous course, they can readily

locate the agricultural regions in the fertile valleys; the grazing tracts on the higher grassy plains or plateaus; the hunting grounds in the great forest belt etc.; but the mining and manufacturing sections require additional attention.

Mines may be studied in connection with the structure of the continents, or may be postponed to the present subject in the system, as they are not essential to any previous step. Although mining regions are generally located along the great lines of upheaval or fracture in the earth's crust, there are many notable exceptions, especially in the cases of coal and salt beds. Very little can be done in the study of causes of location, and it devolves, therefore, on the teacher or text-book to tell where the various minerals and metals are found. Only the principal mining products and localities need be taught; i.e., such as influence commerce or manufacturing centres.

The location of districts engaged in manufacturing is conditioned by the supply of coal or water-power, facilities for obtaining raw material, transporting manufactured articles etc., and pupils should be led to discover the causes to which the various centres owe their growth; for example, Great Britain to its immense beds of coal and iron, and its maritime position, which made it, after the voyage of Vasco de Gama around Africa, the market of the raw material of the world, and the centre of commercial distribution of Europe.

In presenting the subject of occupations, a production map, upon which the political boundaries are also indicated, may be shown the class. The products may at first be reviewed by countries, the teacher showing where the mines are located. Pupils can then, without any difficulty, name the occupations of the various nations of the world. The same plan may be adopted in teaching the productions and

occupations of the States of our Union, if indeed such work is worth the effort. It seems a great waste of time to train pupils to draw from memory maps of the United States subdivided into states. Can one teacher in a hundred do it? The relative location by natural features will prove of much greater and more lasting benefit.

5. COMMERCE.

Under this heading pupils should study the chief commercial centres and routes of trade, together with the articles of exchange. The latter may be easily determined by their knowledge of natural productions and manufactures.

How many cities ought we to teach? is an important question for the teacher. Need we teach more than the great centres of trade, together with a few of historical value? Must our pupils strive to memorize the hundreds, yes, thousands of unimportant cities and towns, merely because they are in our text-books? Has not the time come when we can sweep aside this rubbish that has long been imposed upon children as knowledge? Can we not cut down the list of important cities to about fifty, including historical and capital as well as commercial? and does not the trade of the world pass through about one-half that number? Then can we not teach the use of the atlas, and spare the mind all this lumber? Experience goes to prove that children have a much clearer conception of the commercial world with the few cities firmly fixed, than with the many hundred floating, or rather sinking, in memory. Lead the pupils to discover to what natural influences these cities owe their growth, and how they are related commercially to the surrounding country.

Pupils should know also the principal routes of trade.

These should include ocean routes, trunk-lines of railroads, lake, river, canal and caravan routes. The tendency in this work, also, is to teach too many. A dozen, in all, of the more important, well remembered, are worth more than a hundred vaguely located.

Now the "imaginary trips" may be intelligently taken to all parts of the earth; and pupils can readily tell what goods are exported and imported, how they are transported, and by what routes. But more than that, they can describe the various inhabitants, their homes, dress, natural traits, occupations; in short, the social life of nations. The earth has been truly studied as the "theatre of human actions."

If all the foregoing subjects have been carefully studied, the children are now ready to *discover* a definition of elementary geography.

CONCLUSION.

Shall we say to the children that their journey is ended, or just begun? that they have learned all about this wonderful world of ours, or merely how to spend a lifetime of research and thought in its study? Shall we not rather say with the wise Newton, "We have been only like children playing on the sea-shore, and diverting ourselves in now and then finding a smoother pebble or a prettier shell than ordinary, whilst the great ocean of truth lay all undiscovered before us"?

Can we now sweep aside the dense cloud of mere names and theories that obscure the beauties and wonders of a living moving nature, and so with Carlyle humbly ask: "This green flowery rock-built earth, the trees, the mountains, rivers, many-sounding seas; — that great deep sea of azure that swims overhead; the winds sweeping through it; the

black cloud fashioning itself together, now pouring out fire, now hail and rain; what *is* it? Ay, what?"

What fulness of meaning will now flow from the majestic lines, —

> "To him who in the love of Nature holds
> Communion with her visible forms, she speaks
> A various language."

How much more beautiful our surroundings will also now appear! for have we not associated with their familiar forms the beauty and grandeur of foreign scenes? What pictures, what memories, will rise from every nook and corner of the school-district! "A very sea of thought, neither calm nor clear, if you will, yet wherein the toughest pearl-diver may dive to his utmost depths, and return not only with sea-wraik, but with true orients."

The pupils are now prepared for a life study of the higher relations of man to nature, for such has been the aim of every step in the work. Geography is the trunk whose roots penetrate the past philosophy and history of the globe-structure and man, — whose branches rise and spread beyond our sight in the realm of future science, and whose life-giving principle is eternal law. We have studied the earth of to-day, that we might better imagine that of yesterday and to-morrow; for what is the present but the eve of the past and the dawn of the future?

APPENDIX.

GRADED COURSE OF STUDY.

THE tendency in teaching geography has been to discard the unity of subjects, and make the study a mere vehicle for civil and natural history, just as the science of number is now made to bear the multiplicity of isolated business forms that are forced into our arithmetics. It is the aim of this course of study to show what constitutes the science, or sequence of subjects, and assign them to the different grades or stages of mental development. This assignment of topics to the various classes being conditioned by the intelligence of the pupils, their natural surroundings, and the amount of time allotted to the subject, it is evident that every course of study must be flexible. It is sincerely hoped that this one will be used purely as suggestive of a better, and under no circumstances be slavishly followed.

Particular attention is called to the following: —

(1) At least one-half of the first term of each grade should be devoted to review of such subjects as form the basis of the new step to be taken. This not only quickens the pupils' memories, but also gives the teacher the necessary opportunity to judge their power and knowledge, and to strengthen weak points.

(2) The forms of land and water are to be studied in connection with the forces at work upon them (see Illustrative Lessons, pp. 52 to 70).

(3) Too great stress cannot be laid on the importance of keeping the *records*, which are called for by the lists of questions. Each

child should have a book in which to record the results of personal observations. The lines of investigation should, of course, be directed by the teacher.

(4) The location of the important countries and cities may be taught incidentally to the study of the relief of the continents, if thought best, as a preparation for historical reading. The general location by natural features is sufficient. This will not in the least interfere with the orderly development of the course of study.

(5) The study of the United States during the winter term of the eighth grade, as well as the "Most Important Ten Countries" following, should embrace chiefly the general relief and contour, drainage, natural resources, commercial cities, routes of trade and forms of government. That of our own country may include the *general* location of groups and individual States. Although this is the grade in which the study of our own country naturally belongs, it may be advisable to give a general knowledge of its geography in lower grades, especially if there are many pupils who leave school at an early age. Such lessons should not, however, take the place of the natural development of the science, but should be merely introduced as incidental work in one of the lower grades.

(6) Pupils should be encouraged to read books of travel relating to the continents studied. Teachers should acquaint themselves with the available libraries, and suggest good books to the children. Examine upon all that are read, and so encourage pupils to read carefully, and to remember. Without such examination they may acquire the bad habit of reading for the mere passing impressions.

(7) Learning to cull important current events from daily newspapers should form a very essential part of the civil geography work of the higher grades. The condition of the markets, state of trade, and exports and imports should also be noted.

(8) Every teacher should familiarize herself with the entire course of study, to know the work on which she is building, and toward which she is leading.

(9) Individuality in teaching is developed, not by following a leader, but by working out a principle.

COURSE OF STUDY.

GRADES I AND II.

(See Chapter on Primary Work — First Two Years.)

GRADE III.

GRADE IV.

GRADE V.

TEACHERS' LIBRARY OF GEOGRAPHY.

THE BEST SIX BOOKS GIVING A GENERAL VIEW OF GEOGRAPHY.

1. Earth and Man. — *Guyot.*
2. Comparative Geography. — *Ritter.*
3. The Earth. — *Reclus.*
4. Physical Geography of the Sea. — *Maury.*
5. Physical, Historical, etc., Geography. — *Johnston.*
6. Intellectual Development of Europe. — *Draper.*

WORKS ON METHOD.

Physiography. — *Huxley.*
The Teaching of Geography. — *Geikie.*
Talks on Teaching. — *Patridge.*
First Book of Geology. — *Shaler.*
How to Teach Geography. — *Carver.*
Methods of Teaching Geography. — *Crocker.*
Hand-book of the Earth. — *Hopkins.*

CONTINENTAL RELIEF AND DRAINAGE.

Earth and Man. — *Guyot.*
The Earth. — *Reclus.*
Physical Geography. — *Guyot.*
Class-book of Physical Geography. — *Hughes.*
Geography of River Systems. — *Lawson.*
Elementary Lessons in Physical Geography. — *Geikie.*
Physical Geography. — *Herschel.*
Physical Geography. — *Somerville.*

MATHEMATICAL GEOGRAPHY.

Physical, Historical, etc., Geography. — *Johnston.*
Physiography. — *Huxley.*
Hand-book of the Terrestrial Globe. — *Fitz.*
Mathematical Geography. — *Jackson.*
Astronomy (Primer). — *Lockyer.*
Geography (Primer). — *Grove.*

WINDS, OCEAN-CURRENTS AND RAINFALL.

Earth and Man. — *Guyot.*
Physical Geography of the Sea. — *Maury.*
The Atmosphere. — *Flammarion.*
Elementary Lessons in Physical Geography. — *Geikie.*
The Oceans. — *Reclus.*
Geography of the Oceans. — *Williams.*
Physical Geography. — *Guyot.*

CLIMATE.

Physical, Historical, etc., Geography. — *Johnston.*
Class-book of Physical Geography. — *Hughes.*
Handbuch der Klimatologie. — *Hann.*

SOIL.

The Earth. — *Reclus.*
Physical Geography. — *Somerville.*
Formation of Vegetable Mould. — *Darwin.*

PRODUCTS.

Manual of Commerce. — *Browne.*
First Book of Knowledge. — *Guthrie.*
Vegetation der Erde. — *Grisebach.*
Natural Resources of the United States. — *Patten.*
Geographical Distribution of Animals. — *Wallace.*
Elementary Lessons in Physical Geography. — *Geikie.*
Commercial Products of the Sea. — *Simmonds.*
Geography of the Oceans (tables of commerce). — *Williams.*

MAN.

The Natural History of Man. — *Pritchard.*
Peoples of the World. — *Brown.*
Physical Geography (maps). — *Guyot.*
Earth and Man. — *Guyot.*
Ten Great Religions. — *Clarke.*
The Intellectual Development of Europe. — *Draper.*

HISTORY OF GEOGRAPHY.

Die Geschichte der Erdkunde. — *Ritter.*
Physical, Historical, etc., Geography. — *Johnston.*
Essay on Humboldt. — *Agassiz.*
Cosmos (Otte's Translation), Vol. II. — *Humboldt.*
Pennsylvania School Journal (January, 1888). — *Buehrle.*

MISCELLANEOUS.

Life of Ritter. — *Gage.*
Geographical Studies. — *Ritter.*
The History of a Mountain. — *Reclus.*
The Earth as Modified by Human Action. — *Marsh.*
Physical Geography. — *Houston.*
Town Geology. — *Kingsley.*
Elements of Geology (Parts I. and II.). — *Le Conte.*
Geological Story Briefly Told (Parts I. and II.). — *Dana.*

Geography of Coast-lines. — *Lawson.*
The Ocean World. — *Figuier.*
The Forms of Water. — *Tyndall.*
Essentials of Geography (production maps). — *Fisher.*
Physical Geography (Primer). — *Geikie.*
The Dawn of History. — *Keary.*
History of Civilization in England. — *Buckle.*
Decisive Battles of the World. — *Creasy.*

In compiling the above list, the needs of teachers as well as of children have been kept constantly in view. The aim has been to select from the mass of geographical literature a small but comprehensive *working library.* No book has been recommended that has not been carefully studied and compared with others of its kind. It is in no sense a complete library on the subject, but will doubtless prove a helpful one.

Teachers desiring information in regard to German authors should consult Hall's "Bibliography of Education," sec. xxvii.; also the series of articles on "The Recent Development of Geographical Teaching in Europe," by Goodison, in the "Popular Educator" (Boston), 1886–8. It should not be overlooked that encyclopædias contain many valuable essays on the various topics in geography.

SUPPLEMENTARY READERS FOR CHILDREN.

THIRD-READER GRADES.

Seven Little Sisters. — *Andrews.*
The Seven Little Sisters prove their Sisterhood. — *Andrews.*
The Ten Boys who lived etc. — *Andrews.*
Children of All Nations. — *Anon.*
Little Folks of Other Lands. — *Chaplin and Humphrey.*
Little Lucy's Wonderful Globe. — *Yonge.*
Sea and Sky. — *Blackiston.*

Evenings at Home. — *Barbauld.*
Water and Land — *Abbott.*
Madam How and Lady Why. — *Kingsley.*
Aunt Martha's Corner Cupboard. — *Kirby.*
World at the Fireside. — *Kirby.*
Natural History Readers. — *Wood.*
First Steps in Scientific Knowledge. — *Tenney.*
Winners in Life's Race. — *Buckley.*
Little Folks in Feathers and Fur. — *Miller.*
Life and Her Children. — *Buckley.*
The Fairy-Land of Science. — *Buckley.*
Homes without Hands. — *Wood.*
Georgie's Menagerie.
My Feathered Friends. — *Wood.*
Natural History Series. — *Johonnot.*
Children's Fairy Geography. — *Winslow.*
Peeps Abroad.
Nimrod in the North. — *Schwatka.*
Hans Brinker. — *Dodge.*
Cruise in Chinese Waters. — *Lindley.*
Zigzag Journeys. — *Butterworth.*
Young Folks Abroad. — *McCabe.*
Young Folks in Africa. — *McCabe.*
Family Flights. — *Hale.*
Our Boys in India. — *French.*
Our Boys in China. — *French.*
Little People of Asia. — *Miller.*
The Bodleys Abroad. — *Scudder.*
Water Babies (abridged edition). — *Kingsley.*
Boy Travellers in the Far East. — *Knox.*

SUPERINTENDENTS.

Supt. P. P. CLAXTON, Asheville, N. C.
"I consider it the best book published on the subject of teaching Geography."

Supt. S. T. DUTTON, New Haven, Conn.
"It will be welcomed by all progressive teachers who are not afraid to step out of the beaten track and explore new fields."

Supt. E. C. GLASS, Lynchburg, Va.
"It is a perfect gem. Send me *** copies."

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"A living, spirited, thoroughly organic presentation of the subject of Geography. I am delighted with the book."

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"The best book on the subject of teaching Geography that I have ever read."

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"It is in every way an admirable work, — well written, to the point, and based on sound principles."

Supt. H. S. JONES, Erie, Penn.
"The book is a splendid beginning of better work in Geography."

Supt. F. M. KENDALL, Grand Rapids, Mich.
"I heartily endorse the principles and methods which it sets forth."

GEO. H. MARTIN, Agent of Mass. Board of Education.
"It is so full of suggestions that I should be glad to see it in the hands of every teacher of Geography."

Supt. L. McCARTNEY, Sioux Falls, Dak.
"If it can be placed in the hands and head of every teacher it will revolutionize the teaching of Geography."

Supt. G. V. R. MERRILL, Elmira, N. Y.
"It is just the book needed."

Supt. E. B. NEELY, St. Joseph, Mo.
"It is just such a book as one would expect from the high reputation of the author as a teacher of Geography."

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"We need just such thoughtful and aggressive teachers as the author of this book. It is one of the most suggestive books that I have ever examined."

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"In every way an admirable work. It will certainly be of great benefit to all progressive teachers."

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"A book of great merit, — sound, and replete with suggestions. Its lessons will be of great value to me in educating teachers."

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"It is full of valuable suggestions, and should be widely read and studied."

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"Original thought, and not the 'traditions of the elders,' is the inspiration of this volume."

Miss E. K. MATTHEWS, *Principal Training School, Des Moines, Iowa.*
"'The Child and Nature' is superior to anything of the nature of Geography teaching that it has been my pleasure to examine."

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"An exceedingly forcible presentation of the true method of teaching Geography."

Dr. A. W. NORTON, *Training Teacher, Oswego Normal, N. Y.*
"This book should be in the hands of every teacher. It is one of the most helpful books I have ever seen."

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"An invaluable aid in Geography work for teachers and *Normal training classes.*"

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"It will revolutionize the teaching of Geography."

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"A thoroughly good book, which will tend to improve Geography teaching."

Prin. R. K. ROWE, *Training School, Kingston, Ont.*
"It seems to me that its possibilities for good are unlimited. I should like to see it in the hands of every Canadian teacher."

Dr. N. S. SHALER, *Professor of Geology, Harvard University.*
"An admirable aid to teachers in our common schools."

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"I am delighted with the book, and wish it might be put in the hands of every teacher in the land."

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EDUCATIONAL JOURNALS.

"'*The Child and Nature' deserves all that educational journals have said of it.*"
—DR. JEROME ALLEN, Editor of N. Y. School Journal and Teachers' Institute.

New England Journal of Education, Boston.

"By his writings, summer-school courses of instruction, and institute lectures, the author has become the recognized leader in teaching Geography by sand-modelling. His book from beginning to end is clear, complete and attractive; and the more extensive its use, the more creditable to the profession."

Pennsylvania School Journal, Lancaster.

"The author is perhaps the best theoretical and practical teacher of Geography in the country. We heartily wish that he could be heard from every institute platform in the State, and that his book might be examined by all our teachers and superintendents."

Popular Educator, Boston.

"A work not only original and stimulating, but logical and practical. *It is a geographical classic*, and every teacher should possess it."

Educational News, Philadelphia.

"Mr. Frye is the recognized leader in teaching Geography, and teachers who have listened to him as an instructor at institutes will need no suggestion that they ought to get this book."

New York School Journal.

"An excellent aid for teachers. This book will serve to lighten the teacher's daily work, and make school-days brighter and happier."

Ohio Educational Monthly, Akron.

"Its indirect pedagogical teaching is scarcely less valuable than the direct instruction at which it aims."

Intelligence, Chicago.

"The author has certainly accomplished his object in working out this suggestive book, and every live teacher will be glad of the help it brings."

National Educator, Allentown, Penn.

"A grand new departure from the old-fogy system in vogue so many years. It should be in the hands of every teacher in the world."

Editor William E. Sheldon, American Teacher, Boston.

"I heartily endorse 'The Child and Nature.' The author is doing a noble work, and I rejoice in the grand elimination process now going on."

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"This is one of the most important additions to our aids for the teaching of Geography. No wide-awake teacher can afford to be without it."

Dakota Educator.

"The Superintendent will rejoice in it as a valuable aid in his instruction to teachers; while the working teacher will read it again and again, *and cherish it as a geographical classic.*"

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"'The Child and Nature' is the most remarkable pedagogical work of the year."